Vol. XXIV MARCH-APRIL, 1924 No. 2

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NATURAL HISTORY

ASIA

THE DISCOVERY OF AN UNKNOWN CONTINENT BY HENRY FAIRFIELD OSBORN—LIVING ANIMALS OF THE GOBI DESERT BY ROY CHAPMAN ANDREWS—GEOLOGICAL RECONNAISSANCE IN CENTRAL MONGOLIA BY CHARLES P. BERKEY—JUNGLE LIFE IN INDIA BY COLONEL J. C. FAUNTHORPE—STALKING TSINE IN BURMA BY ARTHUR S. VERNAY—THE DISAPPEARANCE OF THE WILD LIFE OF INDIA BY COLONEL J. C. FAUNTHORPE—EXTINCT ANIMALS OF INDIA BY WILLIAM D. MATTHEW—HAINAN—AN ISLAND OF FORBIDDING REPUTATION BY CLIFFORD H. POPE—THROUGH THE YANGTZE GORGES TO WAN HSIEN BY ANNA G. GRANGER—IN THE REALM OF THE KAMCHATKA BLACK BEAR BY WALDEMAR JOCHELSON

The American Museum is greatly indebted to naturalists and officials of India, China, and Mongolia for their coöperation in assembling materials representative of the great continent of Asia

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY
EXPLORATION·RESEARCH·EDUCATION

美國天產博物院

B.

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The Cover Design Explained

The cover design of NATURAL HISTORY, fittingly commemorating by its Chinese character the important discoveries made in that general area of the East by the Third Asiatic Expedition, requires, in order that it may be properly appreciated, a word of explanation. This has been supplied by Prof. Frederick K. Morris, of the Third Asiatic Expedition, to whom the editor is under obligations not only for his helpfulness in connection with the cover design but for valued counsel throughout the preparation of the issue.

Below the panel at the base of the cover appear the Chinese words for "American Museum of Natural History," between the handsome circular symbols expressing "long life." The undulations that extend just above the Chinese characters and between the long-life symbols are the conventional sea waves of Chinese design. Along the upper border of the basal panel clouds are shown, these being invariably introduced in association with the wave motive. The royal dragons, rising, as they should, from the waves through the clouds, enclose at the top of the cover the Chinese word Asia, the continent to which the subject matter of the issue is predominantly devoted. Read symbolically, the cover may be interpreted as denoting "Long life to the work of the American Museum of Natural History in Asia!"

The elements of the design were suggested by Prof. Henry Fairfield Osborn. Their assemblage into an attractive ensemble and artistic embellishment is the work of Mr. William E. Belanske. To Dr. Lucius C. Porter the magazine is indebted for valuable help in preparing the Chinese symbols. Doctor Porter is dean of Yen Ching University, Peking, and during the present year is exchange professor of Chinese at Columbia University.

Africa

Africa has been the objective of a number of expeditions sent out by the American Museum, some of them consuming years. The experiences and observations of those participating in these expeditions might fill volumes, but from the generality of memories have been culled a few of outstanding interest for inclusion in the May–June issue of NATURAL HISTORY.

RESTORATION BY E. RUNGIUS FULDA OF *PROTOCERATOPS ANDREWSI*, ONE OF THE EGG-LAYING DINOSAURS

The name "*Protoceratops*" signifies "ancestor of the dinosaur with horns on its face." As restored by the artist, these animals show a broad bony frill protecting the nerve centers at the back of the neck from attacks of carnivorous dinosaurs. The horns above the eyes, which give the name ceratopsians to this family, are too rudimentary to appear in this drawing, although they can be seen on the bony surface above the eyes in the fossil specimens. The landscape is that of a desert, in which the wind-blown sand, it is believed, buried the nests of dinosaur eggs

NATURAL HISTORY

VOLUME XXIV MARCH-APRIL NUMBER 2

The Discovery of an Unknown Continent

BY HENRY FAIRFIELD OSBORN

Honorary Curator of Vertebrate Palæontology, American Museum

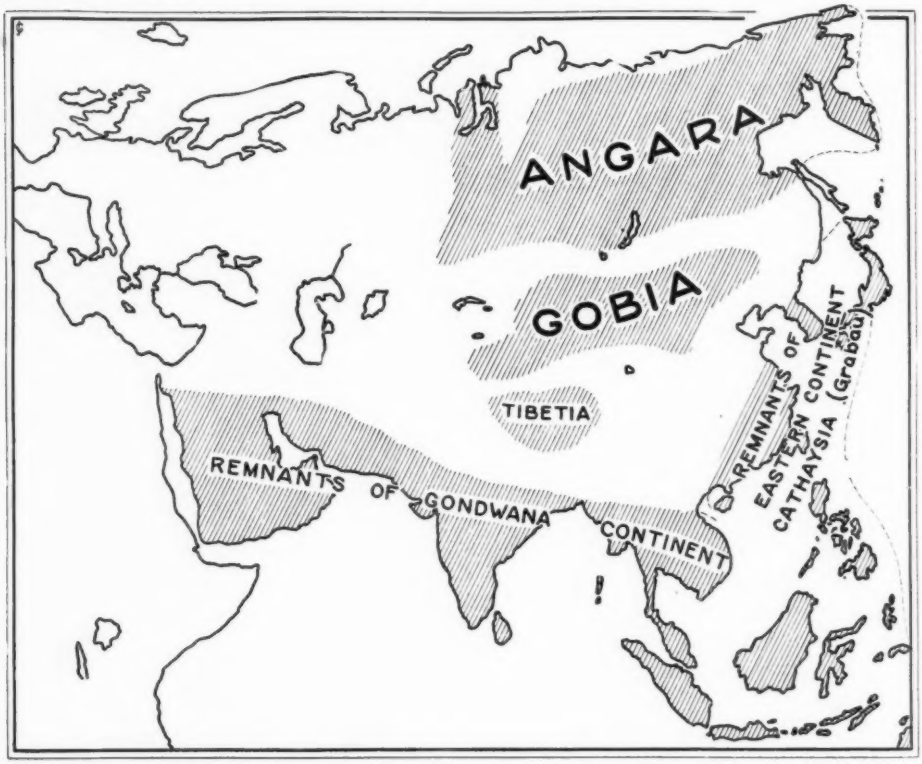
The name Gobia, alluding to the Gobi Desert of southern Mongolia, is given by geologists to a hitherto unknown continental surface in the heart of Asia, the history and life of which is being made known by the explorers of the Third Asiatic Expedition. The present article is a summary of the outstanding discoveries already made and of their significance in elucidating the past history of the earth. It is also a forecast of discoveries which may still be made in the projected five-years' work of the expedition.

THE ancient continent of Asia in the early part of the Age of Dinosaurs was so entirely different, both in geography and in climate, from the present continent of Asia that the familiar modern geographic names would have no significance. Consequently, the palæogeographer forms a league with the palæontologist to describe the animal life; with the palæobotanist to describe the plant life; with the palæometeorologist to deduce the climate from the plant and animal life; and together they give all the information they can to the geologist, on whose rugged shoulders falls the final responsibility of describing the past history of Asia, the "mother of continents." It is this friendly conspiracy of the scientists which is surveying Asia as it were from a very lofty aëroplane, visualizing it as it was long before there were any such mountain ranges as the Altai or the Himalaya, when the seas flowed over the areas of the present mountain tops, when the present great plains, steppes, and table-lands were nonexistent, when not a single form of animal life known today existed, even before what seems to us the far-distant Age of Dinosaurs. It is most interesting to note that such a period "before the mountains were brought forth or ever Thou didst form the earth and the world" was also in the mind of Shakespeare, for in *Henry IV* occurs the remarkable passage.

King Henry. O heaven! that one might read
the book of fate;
And see the revolution of the times
Make mountains level, and the continent
Weary of solid firmness, melt itself
Into the sea! and, other times, to see
The beachy girdle of the ocean
Too wide for Neptune's hips; how chances
mock,
And changes fill the cup of alteration
With divers liquors!

The period we are interested in is that in which the previously unknown continental surface of Mongolia emerged from sea level. The palæogeographers Edouard Suess of Vienna, Bailey Willis of the United States Geological Survey, and Amadeus Grabau, formerly of Columbia University and now of the Geological Survey of China, have named the elements of a titanic archipelago which preceded the present continent of Asia. To the north of Gobia was the solid land of the ANGARA of Suess, taking in a large part of Siberia; to the west was the Mongolian insular plateau, embracing the Gobi, the Tarim, and Dzungaria; to the southeast was a

great plateau corresponding with existing Tibet; occupying a large part of the present peninsula of India was the hypothetical GONDWANA land mass of Suess, which, according to the hypothesis of this distinguished author of *The Face of the Earth*, extended around the southern hemisphere like a great girdle, bridging both the South Atlantic and the Pacific oceans. Between these ancient land masses were areas of shallow seas, known to geologists as geosynclines, and finally destined to emerge as great mountain ranges. It remained for Grabau to give the name GOBIA, derived from the present Gobi esert, to the great land mass which rose in the heart of Asia during the early period of the Age of Reptiles and has persistently been rising despite the erosion of the mountain summits bordering its sides, rather than sinking back to sea level. Gobia, therefore, hitherto a reputed but historically unknown continental surface, is that portion of the heart of Asia of which the Third Asiatic Expedition is writing the history.



Palæogeography of Asia.—To the north, are the remnants of the granitic continent named ANGARA by Suess; to the south, the remnants of the continent named GONDWANA by Suess, who believed that it encircled the Southern Hemisphere; in the center, the continent of GOBIA, which corresponds with modern Mongolia. Between these ancient land masses there flowed the tides of epi-continental seas directly over regions which are now the mountain summits of the Himalaya, the Altai, and other great mountain ranges. These mountain ranges are relatively youthful; they arose during the Age of Mammals. (See the pictorial table on p. 139.)

It requires constructive imagination tempered by cold facts, as well as some moral courage, to put forward a map of Gobia at the present time. "Fantastic and useless" will be the first criticism of many scientists, while

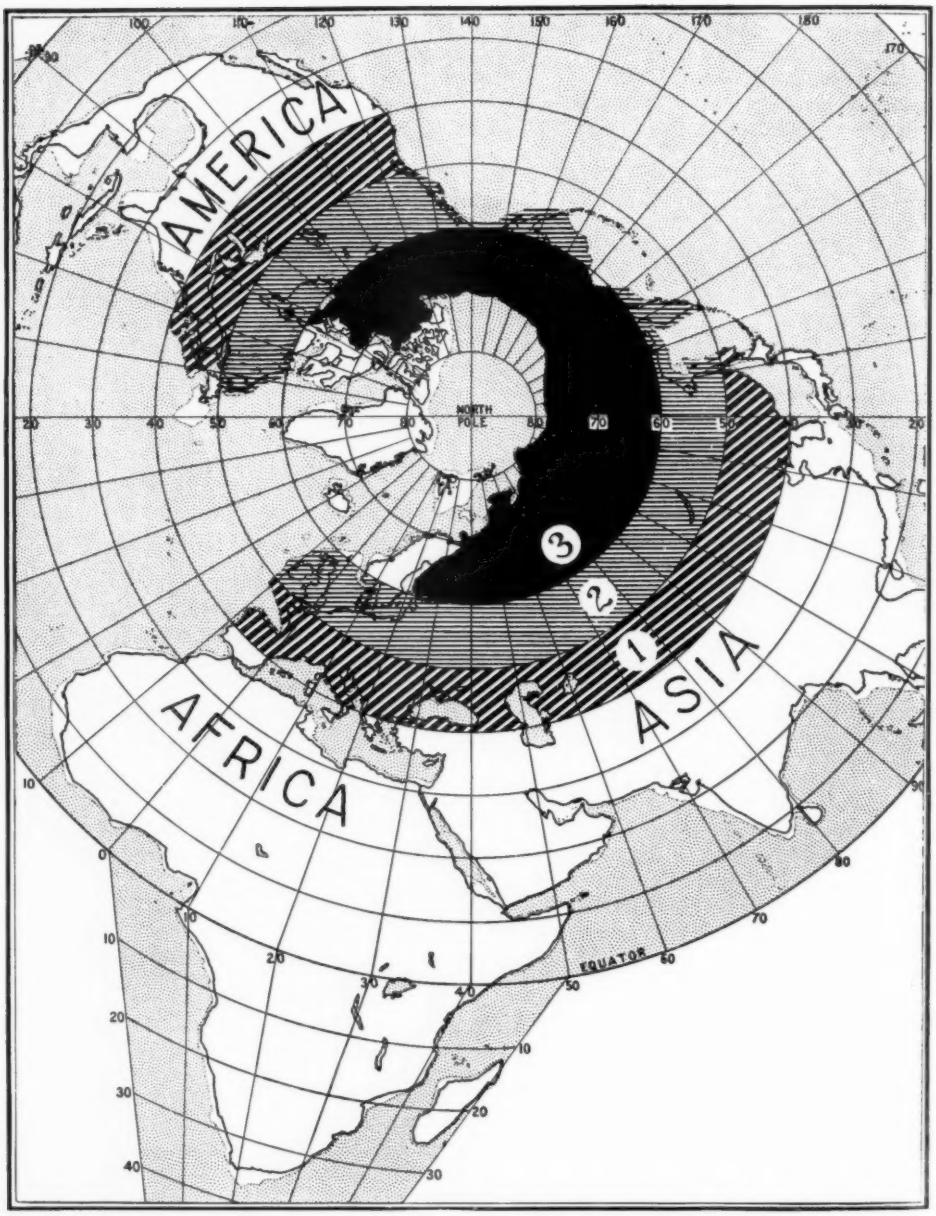
others will regard it more truthfully as a tentative or working hypothesis that will be very materially altered by the time the Third Asiatic Expedition has completed its thorough survey of Mongolia. In the meantime, let us imagine that such an unknown continental land mass existed, raised three or four thousand feet above sea level, thus enjoying a relatively dry and stimulating climate. The mountains which bordered it on the north and south furnished a double shelter, serving to give it a relatively temperate climate and a moderate rain supply. One of the most interesting conclusions already reached by the geologists is that this great plateau had only a very moderate rain supply from the very beginning of its history and even passed through certain long periods of aridity.

FORMATIONS AND LIFE ZONES

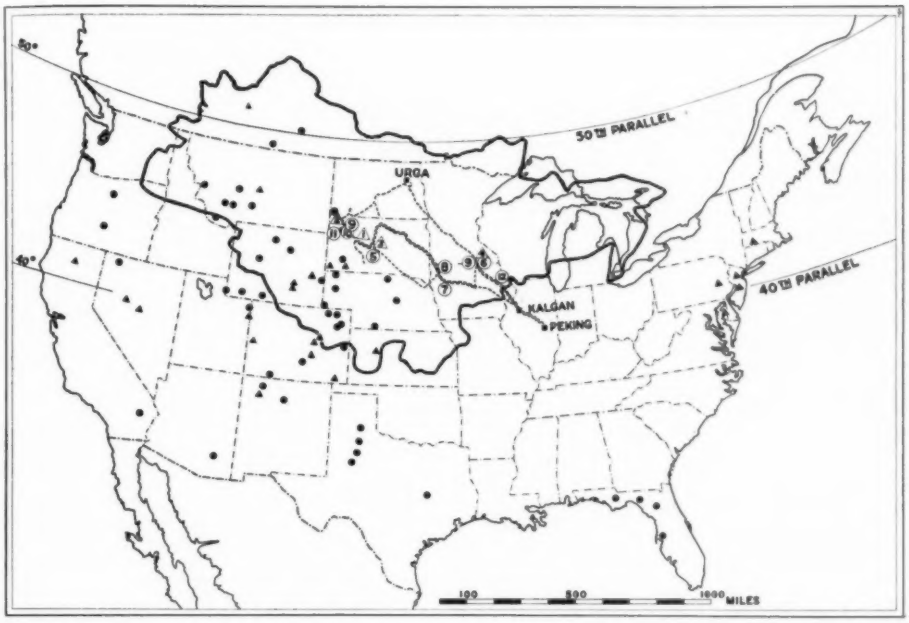
These secular cycles of moisture and drought are recorded in the kinds of rocks scattered in very broad but relatively thin layers or *formations* over the borders of this great upland country. These formations are known as epi-continental because they are laid on the surface of the continent and contain land fossils, as distinguished from those laid along the sea borders of the continent, which invariably contain marine shells. A formation is local; it may be one hundred miles or several hundred miles in extent, whereas the 'life zone' may extend around the world.

In the list of popular and scientific papers which have already been written about the Third Asiatic Expedition, as shown at the end of this article, are included those containing preliminary descriptions of the various assemblages of life to which we give the collective name *life zones*, the meaning of which may be indicated by reference to present life conditions, or rather to conditions which prevailed before civilized man destroyed the life zones which he found encircling the Northern Hemisphere. For example, (2) the life zone of the stag of the genus *Cervus* (see zonal map p. 136) extends between the fiftieth and sixtieth parallel of latitude, from Great Britain directly across northern Europe, central Asia, and North America as far east as New York and New England. Similarly, just north is (3) the life zone of the moose of the genus *Alces*, which extends from Maine through northern United States and southern Canada directly across to Scandinavia. Also in (3) to the north is the life zone of the reindeer of the genus *Rangifer*, extending from Scandinavia across northern Europe, Asia, and North America. South of the natural zone of the stag and practically parallel with it is (1) the life zone of the bison, a typical animal of the plains. The reason each of these animals keeps to its own life zone is that each seeks forms of plants and degrees of temperature which it most enjoys. All animals have their pleasures in life, their likes and dislikes in food and in climate. As humorously expressed in the Munich adage: *Ein jedes Tierchen hat sein Plaisirchen;* that is, each little beast has its feast. This natural principle of the enjoyment of life—that like seeks like—is of very great aid to the geologist and palæontologist because it applies not only in recent time but far back into the most remote periods of geologic time.

As "birds of a feather flock together," and mammals of the same species migrate together, so dinosaurs of similar forms and habits of life found their way into similar environments around the whole Northern Hemi-

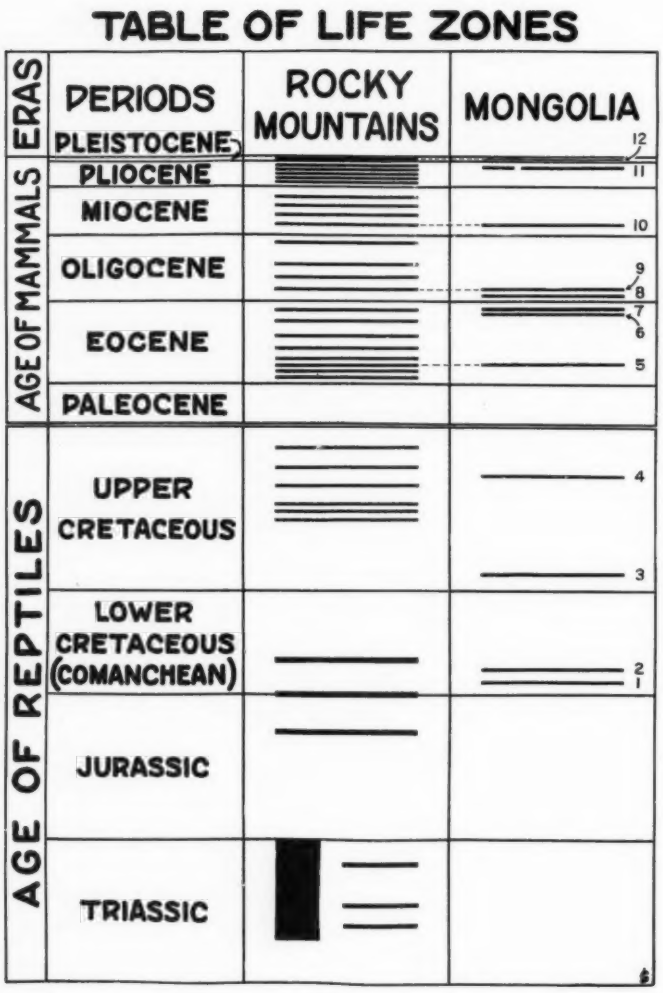


The Northern Hemisphere, showing the three great life zones which encircled the polar regions. (1) Fortieth to fiftieth parallel: favorite zone of the dinosaurs during the Age of Reptiles and of the hardy bison, or northern cattle, during the Age of Mammals. (2) Fiftieth to sixtieth parallel: zone near the southern border of which dinosaurs have been discovered; zone of the *Cervus*, the hardy northern stag, and the wapiti in the Age of Mammals. (3) Area north of the sixtieth parallel; zone in which Cretaceous terrestrial life is still unknown; zone of the reindeer, *Rangifer*, and of the moose, *Alces*, in recent times



Map of Mongolia (heavy black lines) superimposed upon map of the United States.—Both regions are drawn to the same scale, and their latitudes, fortieth to fiftieth parallel, coincide. Dotted lines show the route of the expedition. The chief fossil dinosaur localities of the United States are indicated by solid black triangles and the chief fossil mammal localities by solid black circles; those of Mongolia appear as open triangles and open circles, with index numbers signifying: (1) Ashile, (2) Ondai Sair, (3) Djadochta, (4) Iren Dabasu, (5) Gashato, (6) Irdin Manha and Arshanto, (7) Shara Murun, (8) Ardyn Obo, (9) Hsanda Gol (west) and Houldjin (east), (10) Loh, (11) Hung Kureh, (12) Olan Diske

sphere. They may have wandered out of their favorite life zone—they probably did—but their remains are found in greatest number between the parallels of latitude and along the ancient isotherms of climate where life was most agreeable to them. This very interesting observation of the general likeness of past life zones with existing life zones is made clear when we project an outline map of Mongolia upon an outline map of the United States as indicated in the map figured above. Taking the line of the fortieth parallel as a key, we observe that the very richest dinosaur beds of the close of the Age of Reptiles that have been discovered in the United States and Canada during the past half century are not far distant in latitude from those we have found recently in Gobia. Thus the great life-zone belt of the horned dinosaurs lies chiefly between the fortieth and forty-fifth parallels and extends like a broad ribbon of dinosaur dominance over the ancient continent of Gobia eastward and westward. The reason why this belt of dinosaur life is broken is that most of the formations that contained these fossils at intermediate points have all been washed away and destroyed by water erosion or by the great glaciers of the Ice Age. We know that dinosaurs closely related to those found in Mongolia in the Upper Cretaceous occur as far west as Great Britain and as far east as the New Jersey coast in the United States. These remnants of the dinosaur belt do not prove by any means that these reptiles lived in colonies or in isolated patches; on the contrary, it is highly



The chief life zones thus far discovered by the Third Asiatic Expedition in Mongolia (right-hand column 12–1) as compared with life zones known in the Rocky Mountain region (center column).

In descending order these life zones of Mongolia are: Olan Diske (12), Pleistocene; Hung Kureh (11), Upper Pliocene, *Cervus* zone; Loh (10), Lower Miocene, primitive mastodon zone; Hsanda Gol and Houldjin (9), Oligocene, *Baluchitherium* zone; Ardyn Obo (8), Lower Oligocene; Shara Murun (7), Upper Eocene, protitanothere zone; Irdin Manha—Arshanto and Pang Kiang (6), Upper Eocene; Gashato (5), Lower Eocene. The precise positions of these life zones remain to be determined by more thorough investigation. Iren Dabasu (4), Upper Cretaceous zone; Djadochta (3), *Protoceratops* zone; Ondai Sair (2), *Protiguanodon* zone; Ashile (1) *Psittacosaurus* zone.

Mr. Walter Granger, palæontologist of the expedition, is preparing a paper for the *Bulletin* describing each of these life zones

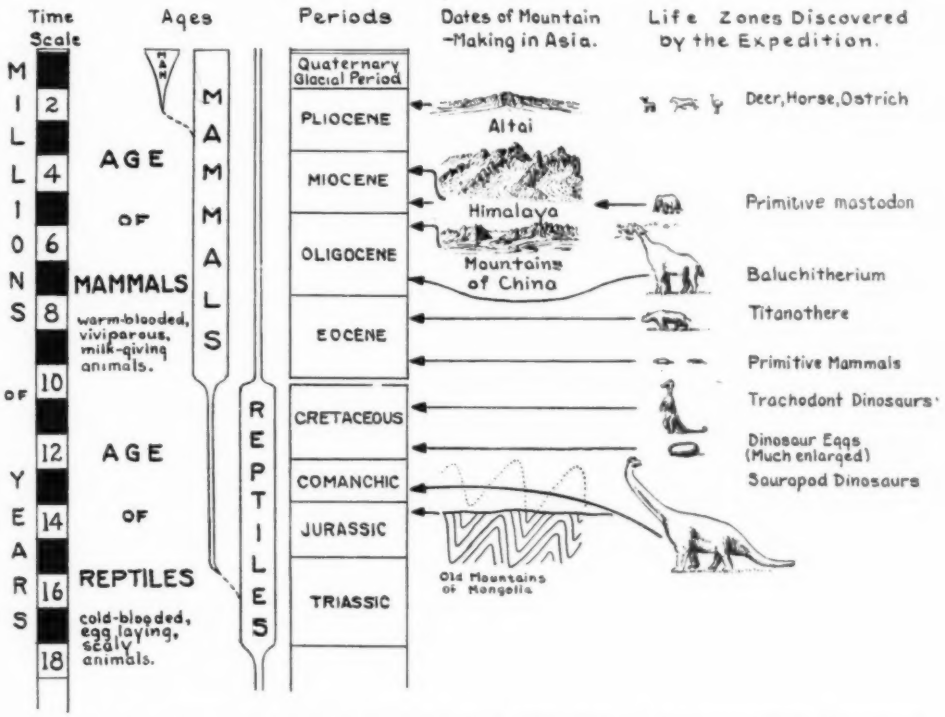
probable that, like the stag, the reindeer, the moose, and the bison, these remnants represent formerly continuous life zones.

We thus reach the broad significance of the two outstanding discoveries of the Third Asiatic Expedition: first, the discovery of a hitherto unknown and extremely ancient continental surface of Gobia right in the heart of Asia, where the conditions were highly favorable for the origin and evolution of all forms of continental life over a period of time variously estimated as from ten millions to sixty millions of years in duration; second, the discovery that this inland continent lay at the very center of a series of great life-zone belts which extended around the Eastern and Western Hemispheres, along the lines of the fortieth and forty-fifth parallels. Hitherto we have known only the eastern and western ends of these great broad bands of life; now we are exploring in the very center of these life zones.

The animals and plants of these life zones enable us to reckon the steps or stages in the passage of geologic time —not the length of time but the suc-

cessive divisions of time. For example, dinosaur time in Mongolia is also dinosaur time to the far east in New Jersey and to the far west in Great Britain. The Age of Dinosaurs is succeeded by the Age of Mammals, when we find zones represents a very long period of time in which it is possible for a community of mammal life to be established by eastern and western migration.

In the diagram on the opposing page these life zones are indicated by black



Popularized summary by Prof. Frederick K. Morris of the chief palæontologic discoveries of the Third Asiatic Expedition during the seasons of 1922–23. The reader is referred to the map on p. 134 for comparative study

closely similar species of mammals occupying these broad east and west life zones along similar climatic isotherms. By means of this great palæontologic clock we are able to subdivide the ages more closely. For example, the dawn period of the Age of Mammals is known as Eocene time, derived from Greek ἠώς (dawn) and καινός (recent). In the Rocky Mountain Eocene we have discovered during the past thirty years no less than sixteen distinct mammal life zones, one above the other; each of these life bands placed in a Rocky Mountain column and a Mongolia column. Bands across both columns indicate those life zones already discovered in both Mongolia and North America. It will be seen that there are still a great many gaps in the Mongolia column; to fill these gaps is one of the main objects of the continuation of the Third Asiatic Expedition for the next five years.

THE NEW CONTINENT OF ANCESTRAL DINOSAUR LIFE

In the lower half of the table on p. 138 the reader will see a series of en-

tirely new epi-continental life zones, which are of Lower Cretaceous age—new, because upland formations of this age have never before been discovered and the upland life has not been known before. This part of the column corresponds in time with rocks deposited near sea level in North America to which the name Comanchean has been applied because they are now best known in lands formerly inhabited by the Comanche Indians. Gobia is not only a new continent; it is a new world of ancestral dinosaur life. Here we are in the halfway period of dinosaur evolution—the great amphibious dinosaurs of the preceding Jurassic Period are dying out; we are now in the beginning of the reign of land dinosaurs and especially of the upland dinosaurs living away from the sea. Among the hitherto unknown dinosaurs of various kinds are those listed in the table on the opposing page.

The first four dinosaurs listed in this table are the only ones thus far described from the wonderful collection of seventy-two skulls and eleven complete skeletons found in the life zone of *Protoceratops andrewsi*, which is destined to become one of the classic life zones of the world.

ANCIENT DINOSAUR LIFE ZONES OF THE LOWER CRETACEOUS

Below this classic *Protoceratops* life zone are the two dinosaurs named at the bottom of the list on p. 141; they may prove to be of similar geologic age, probably Upper Jurassic or Lower Cretaceous. The little animal *Psittacosaurus*, about a yard's length, is superbly preserved exactly as it coiled up before being overtaken by sudden death. A really remarkable feature is the presence of two bony horns bristling out at the side of the head as a warning to hungry carnivores; there is also evidence of skin armature to protect the side of the jaw and the sensitive throat, which leads to the belief that this little leaf-eating animal was developing in the direction of defense by means of dermal armature rather than of escape from its enemies by speed. In contrast, there is the *Protiguanodon*, also a leaf-eater, which was apparently developing rapid powers of locomotion upon its hind limbs; this animal was found eighty-five miles distant from *Psittacosaurus*, but may be of the same geologic age. *Psittacosaurus* was discovered in the year 1922 in a formation 1500 feet in thickness. Among these beds were deposits of fine paper shales containing insects which will give us an insight into the climate; this was probably humid. Evidence of humidity is found in the presence in the same life zone of giant amphibious dinosaurs, surviving from Jurassic time and known as Sauropoda, which could have lived only in great swamps or shallow lakes.

A wet period is indicated also in the Ondai Sair beds, 500 feet in thickness, in which the leaf-eating *Protiguanodon* is found. This superb skeleton occurred in deposits of gray sands and gravels, overlying which were paper shales containing remains of both the insect and fish fauna of the time. The animal most nearly allied to the *Protiguanodon* is the dinosaur known as *Hypsilophodon foxi*, found in the Lower Cretaceous or Wealden, named after the "weald" of Sussex, England. This dinosaur has teeth adapted to leaf-eating like those of certain iguanid lizards.

THE ANCESTORS OF THE HORNED DINOSAURS

The overlying Djadochta beds, which contain in such abundance the *Protoceratops andrewsi* and the three

PERIOD	SCIENTIFIC NAME	SIGNIFICANCE	LIFE AND HABITS
Beginning of Upper Cretaceous Time	*Protoceratops andrewsi*	Ancestor of the great American dinosaur *Triceratops*, with horns above its eyes. This is one of the animals which laid the now famous dinosaur eggs that in turn have made "dinosaur" a household word all over the civilized world.	An herbivorous dinosaur.
	Fenestrosaurus philoceratops	A small birdlike dinosaur, remains of which were found resting on top of one of the nests of dinosaur eggs; hence the specific name *philoceratops*, signifying "ceratops lover."	Egg-eating or ovivorous. This dinosaur was without teeth.
	Ornithoides oshiensis	A name given in allusion to the fact that the reptile was found in the basin Oshih, with numerous teeth.	A dinosaur birdlike in its skull form.
	Ovoraptor djadochtari	A wonderfully alert little egg-snatcher, hence Ovoraptor of the Djadochta formation.	Swift-moving, carnivorous dinosaur.
Lower Cretaceous Time	*Psittacosaurus mongoliensis*	A parrot-beaked little dinosaur of Mongolia, found in the formation known as Ashile.	Leaf-eating dinosaur.
	Protiguanodon mongoliense	A possible ancestor of the great iguanodonts of the Upper Cretaceous, leaf-eating dinosaurs which extended over the whole Northern Hemisphere, the name iguanodont referring to the fact that these reptiles had teeth resembling those of some iguanid lizards which are herbivorous.	Leaf-eating dinosaur.

raptorial dinosaurs *Fenestrosaurus*, *Ornithoides*, and *Ovoraptor*, indicate an entire change of climate into a semi-arid condition, which is demonstrated by the manner in which the fossilized remains are found, namely, in a fine reddish sand partly of wind origin, partly deposited in shallow lakes or flood plains. Much of this sand is noncohesive and can readily be removed with the tool. Probably at this time Gobia was assuming the appearance of a savanna country, partly open, partly forested, with evaporating or

The American Museum camp on top of the Lower Cretaceous formation of Ashile.—The elevation extending along the back is Oshih Mesa, which gives the region its name. It was here that the Third Asiatic Expedition discovered remnants of a giant amphibious dinosaur representing the order Sauropoda

playa lakes such as we now observe in Nevada. The Djadochta formation, which was deposited in this way, is 500 feet in thickness and is now eroded into cliffs of glorious flame-color, at the foot of which dinosaur remains were found. This will become one of the classic formations of the world, because of the extreme richness and variety of the fossils found there, giving us an insight into the entire life of the unknown period. Absolutely unique in the records of palæontologic discovery are the stages of development of the frill-necked *Protoceratops andrewsi*, the species named for the leader of the Third Asiatic Expedition, because it gives us all stages, from the little skeleton contained in the egg up to the fully matured animal, which had the general appearance shown in the frontispiece of this article. Only the very closest examination of the skull above the orbits and above the nostrils reveals the minute rudiments of horns above the eyes to which the family name Ceratopsidæ refers. In life these were covered with dermal horns serving as defense against the carnivorous dinosaurs. The bony frill at the back of the skull protects the most sensitive part of the neck, that which was most exposed to attack among the reptiles and among the mammals. The three kinds of carnivorous dinosaurs already found were incapable of attacking the *Protoceratops*. Doubtless in time we shall discover carnivorous dinosaurs of larger size.

DINOSAUR LIFE ZONES OF UPPER CRETACEOUS AGE

The animals described above are all new to science; they are doubtless ancestral to the great dinosaurs of the Upper Cretaceous, which extended their sway over the whole Northern Hemisphere, chiefly in traveling eastward and westward between the fortieth and forty-fifth parallels of latitude. Fortunately we discovered at

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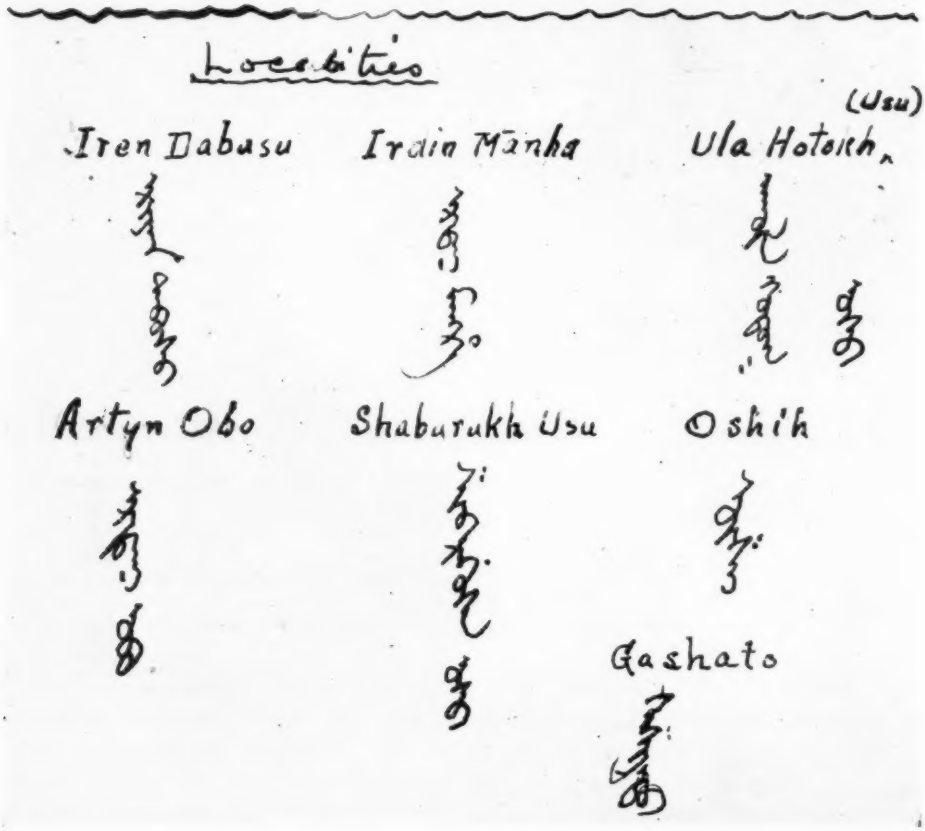
This locality yielded the ancestor of the iguanodont family known as *Psittacosaurus*. The superbly preserved skeleton of this animal, which is about seven feet in length from head to tail, was found somewhat to the right of the picture, in the deep cut that extends in that direction. Photograph by Roy Chapman Andrews

Iren Dabasu an Upper Cretaceous dinosaur bed containing at least three kinds of carnivorous and herbivorous dinosaurs, the remains of which were excavated from several great quarries near the salt playa lake, which gives the Mongol name "Iren Dabasu." We have not yet had time to study these animals with care but in size and proportions they remind us strongly of the Upper Cretaceous iguanodonts and carnivores of Wyoming and Montana, belonging to at least three types—the iguanodont, the large carnivore, and the ostrich-mimic type. Singularly enough, we have not thus far found the ceratopsian dinosaurs in this bed, probably because it represents a shore level deposit rather than the upland deposit in which the horned herbivorous dinosaurs would naturally occur.

SCIENTIFIC NAME	SIGNIFICANCE	LIFE AND HABITS
Iguanodontia	Bipedal dinosaurs living along shore lines and having teeth like those of some of the iguanid lizards.	Large leaf-eating dinosaurs.
Ornithomimidæ	Ostrich-mimicking dinosaurs.	Slender, browsing dinosaurs, toothless.
Theropoda	Having three-toed clawed feet like the birds.	Large flesh-eating dinosaurs.

The difference between the Iren Dabasu beds and the more ancient *Protoceratops* beds is that, in the interval of time separating the two, broad land connections were formed with Europe on the west and with North America on the east, and the dinosaurs had begun to migrate in large numbers in both directions but especially, it is believed, into North America. Consequently, we expect to find that the



Page from the diary of Mr. Walter Granger.—In all Mongolia Urga, the capital, with 20,000 inhabitants, is the only city. Two towns, Uliassutai and Kobdo, correspond in size with our villages. Other localities indicated on maps as towns are merely wells or springs of salt deposits—stopping places for caravans. These localities have picturesque names; for example, Iren Dabasu, "Valley of the Salt Lake," Irdin Manha, "Valley of the Jewels."

dinosaurs of Iren Dabasu have close relatives among the dinosaurs of Wyoming and Montana. When dinosaurs migrated, they did not change their characteristics; it is possible that we may discover either identical or very closely related species in Mongolia and in Montana, as we did among the mammals of more recent age. In Iren Dabasu also there will be found dinosaurs of less adventurous spirit, which did not migrate to America at all but preferred to travel in the direction of Europe. The result of these differences in migrating habit is that in western Europe we find large shore-living, leaf-eating iguanodonts very different in details of structure from their contemporaries in America.

In Upper Cretaceous time the land dinosaurs were absolutely dominant in the great life zone encircling two-thirds of the Northern Hemisphere. Remnants of this dinosaur empire have been discovered in Great Britain, France, Belgium, Austria Hungary, and Mon-

golia. It is highly probable that when the whole high plateau region of Asia is known, the geographic gaps in this great life zone will be filled; at present we depend chiefly upon the extraordinary yield of the Cretaceous dinosaur beds of Alberta, Montana, Wyoming, Colorado and northern New Mexico for our knowledge of the entire dinosaur world. In its majestic forms—such as the great carnivore *Tyrannosaurus*, the three-horned herbivore *Triceratops*, the slow-moving and heavily-armored *Ankylosaurus*, the stately shore-living and amphibious trachodonts, the fleet-footed, bird-mimicking *Ornithomimus* and the ostrich-mimicking *Struthiomimus*—it presents an assemblage of life not paralleled before or since in the whole history of the earth. The only life period approaching it is that which marked the close of the Age of Mammals, when the horses, giraffes, elephants, hippopotami, and other quadrupeds reached the acme of their evolution.

At the very moment of this great life climax, which had been in the process of evolution during the entire Age of Reptiles, namely, during Triassic, Jurassic, and Cretaceous times, the whole dinosaur world became extinct. Among the many theories as to the cause of this extinction not the least probable are that the dinosaurs failed to protect their young, either during the nesting stage or immediately after hatching, or that some new marauder (such as we named *Ovoraptor*) of the dinosaur nests arose which sought out the eggs and fed upon their rich food supply. In this connection the discovery of three kinds of dinosaur eggs in three separate nests is extraordinarily interesting, and of this we shall speak more fully in another number of NATURAL HISTORY.

CHIEF LIFE ZONES OF THE AGE OF MAMMALS THAT HAVE BEEN DISCOVERED

The extinction period of the dinosaurs marked the dawn of the Age of Mammals. The life conditions in Gobia, wonderfully favorable to the production of a great variety of dinosaurs, were no less favorable to the origin and development of highly varied mammalian life, and especially does this apply to the five-toed ancestors of the hoofed animals. Discovery of the ancestral five-toed horses, tapirs, rhinoceroses, and titanotheres, which we are confident will be found on the border line between the Age of Reptiles and the Age of Mammals, is another of the main reasons for the continuation of the Third Asiatic Expedition.

The chief fossil sites thus far discovered have been enumerated in descending geologic order in the following list. The localities (1) to (4) have been omitted in this connection as they are treated elsewhere in the text. The geographic position of these several sites is indicated in the map of Mongolia that has been superimposed upon the map of the United States (see p. 137).

OLAN-DISKE [or Disek] (12). These beds were investigated by J. G. Andersson and are reported in his "Essays on the Cenozoic of Northern China" (*Memoirs of Geological Survey of China*, Ser. A, No. 3, March, 1923). The localities are in southern Mongolia, not far from Tabul, in the level country south of the American Museum camp No. 1. At OLAN are sands, well stratified, and exposed to a depth of 50 feet; with clay intercalations, and, at the base, layers and lenses of angular gravel. Large bones, which, it was inferred, belonged to an elephant or mammoth, were collected here. A rhinoceros skull was brought in from DISKE. So far these are the only undoubted Pleistocene fossils of which we have record in Mongolia.

HUNG KUREH (11). The fauna of this formation is scanty. The most notable of its animals is a fine stag related to the wapiti

This restoration by Mr. Charles R. Knight shows a *Mesonyx* preying upon the skull of a *Loxolophodon*. The *Mesonyx* is a Rocky Mountain relative of the giant carnivorous mammal *Andrewsarchus*, named after Leader Roy Chapman Andrews (see p. 147)

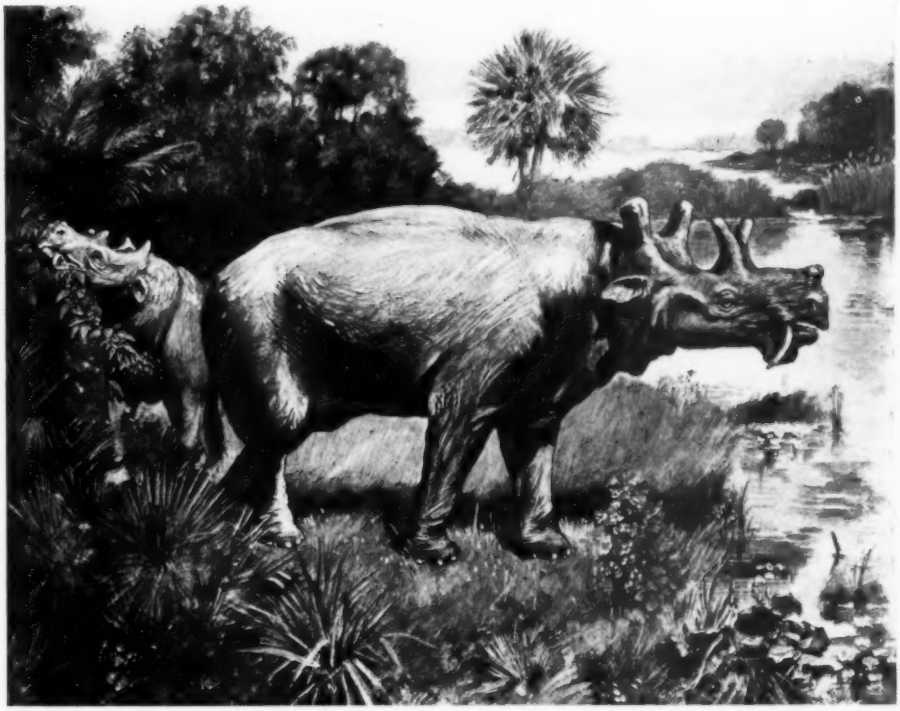
or "elk," but fragmentary remains of two or more antelopes, a small horse, perhaps three-toed, a large camel, a proboscidean of some kind, and a beaver show that the animals of Mongolia at that time were related to the faunas of the late Pliocene of Europe and early Pleistocene of North America. To decide how close the relationship may be, more complete specimens are needed.

Loh (10). In these beds have been found remains of a primitive mastodont which may be related to the *Trilophodon* of France; also of a rhinoceros whose particular relationships are not yet known. It has been proved that this animal is a small *Baluchitherium*, of Middle Miocene Age.

Hsanda Gol and Houldjin (9). This is the life zone of *Baluchitherium grangeri*, the giant tree-browsing, hornless rhinoceros. From this zone Matthew and Granger have described eight genera of carnivores resembling those in France and in our Rocky Mountain region; nine genera of rodents, including an African family; two genera of insectivores; a small hornless rhinoceros, companion of the giant *Baluchitherium;* the ancestral type of the deer family; a member of the giant pig family.

Ardyn Obo (8). These beds are 500 feet in thickness, consisting of sands, gravels, and clays. The life zone resembles that of the Phosphorites beds of France, containing especially the amphibious type of rhinoceros known as *Cadurcotherium*. Here too are found the first of the chalicothere family with split hoofs, known as *Schizotherium;* also many primitive wolves, *Cynodictis*, and the type of deer, *Eumeryx*, important because it may be the ancestor of the deer family, which undoubtedly arose in Asia. These beds are regarded as of Oligocene age.

Shara Murun (7). This horizon is 150 feet in thickness, consisting of sandy clays and moulding clays, with sandstone beds at the top. The clays are rich in fossils, especially titanotheres, which resemble those of Lower Oligocene age in northern Wyoming and South Dakota. This seems to be the climax of the titanothere period in Mongolia. The species *Protitanotherium mongoliense* is almost identical in tooth structure



A restoration by Mr. Knight of *Loxolophodon*, from the Rocky Mountain region. The presence in Mongolia of an animal belonging to the same order was established through the discovery of two of its upper teeth, one by Leader Andrews and the other by Professor Osborn

with *Protitanotherium superbum* of northern Utah. There are also extremely long-limbed rhinoceroses in this formation, possibly ancestral to the long-limbed *Baluchitherium*.

IRDIN MANHA—ARSHANTO, AND PANG KIANG (6). The IRDIN MANHA is the most majestic Upper Eocene formation thus far discovered, probably of flood-plain origin, extending for a hundred miles north and south like a gigantic platform. Its life zone is extremely rich and bears very close resemblance to a similar Upper Eocene life zone of northern Utah, due to the presence of primitive carnivores, insectivores, and two kinds of primitive even-toed ungulates. The two kinds of odd-toed ungulates which dominate are the large titanothere known as *Sphenocœlus* and the diminutive cursorial *Desmatotherium*—these little animals are extremely numerous. In this fauna occurs the giant carnivorous animal named *Andrewsarchus* after the leader of the expedition, far surpassing in size the largest of its American relatives, *Mesonyx*. Even more surprising is the discovery in these beds of two teeth, undoubtedly belonging to one of the giant uintatheres of the Rocky Mountain region. One of the teeth was found by Leader Andrews, the other by the present writer. The American tooth strongly reminds us of the genus *Loxolophodon*, named from its yoke-crested teeth. The ARSHANTO beds consist of reddish clays, lying at the base of the IRDIN MANHA, and have thus far yielded only the remains of small odd-toed ungulates, probably ancestral to those which occur in such vast herds in the IRDIN MANHA formation. The PANG KIANG beds are probably older than the IRDIN MANHA beds, and are not at all rich in fossils. They have thus far yielded only the small jaw of a rodent, not improbably of Middle Eocene age.

GASHATO (5). This formation, 200 feet in thickness, of brown and red sandy clays, lies above the *Protoceratops* zone of DJADOCHTA. To the keen eye of Mr. Walter Granger it disclosed a number of small fossil jaws, from four inches to less than one inch in length,

found only in small pockets. So far as examined, these animals are of archaic type and we hope to prove that they are the long-sought mammals of either Upper Cretaceous or Lower Eocene age. If we find hoofed animals at this period, we may surely anticipate that they will have five digits on both the front and hind foot and we shall be in the presence of the greatly desired life zone of the five-toed ungulates.

MAMMALS STILL TO BE DISCOVERED

It is possible that a five-toed period in the evolution of the higher type of hoofed mammals may be recognized in the Gashato formation (5); it is also possible that this cradle of the five-toed hoofed race may be in some other more northerly part of the plateau region of Asia. All that we can feel sure of today is that these long-sought five-toed horses were evolving somewhere in a dry upland country, because it is only in such a country that the loss of the first digit of the hand and foot would occur. Thus we are seeking in Gobia or to the north a country where the thumb on the hand and the big toe of the foot were lost, because when these quadrupeds arrived in America, in Lower Eocene time, they had without exception left their thumb and big toe behind them.

Surprising as is the great list of mammals already discovered, a list which includes representatives of upwards of thirty genera and forty species of many different families, the long list of *undiscovered* mammals is no less surprising. We had confidently expected to find ancestral four-toed horses in some of these formations; not a single horse has thus far been found. This leads us to suspect that the great horse-breeding country may have been farther north, on the continental mass of Angara. Surprising also is the absence of proboscideans,—of mastodons or ancestors of the elephant family,—which first appear in the Loh formation of Lower Miocene age.

Surprising too is the fact that many of the mammals thus far discovered are not new to science, but are more or less closely related to mammals previously known either in the Rocky Mountains or in France. It is not surprising that we have thus far found no primates, because these animals are always the most difficult to discover. We might expect to find them in suitable environment of Lower Miocene or later age, because in some older beds of France lemuroid primates are relatively abundant.

Therefore, among the chief objects of the remaining five years of the expedition are the search for primates, especially those which may point toward human ancestry, and the search for Basal Eocene and Upper Cretaceous ancestors of the higher types of quadrupeds of the Northern Hemisphere. During the remaining period of the expedition the most diligent effort will be made and the keenest powers of observation will be devoted to filling in these two great gaps in our knowledge of the mammals of Gobia.

POPULAR AND SCIENTIFIC ARTICLES

In NATURAL HISTORY have appeared several articles from the pen of Mr. Roy Chapman Andrews dealing with the work of organization and the achievements of the Third Asiatic Expedition. Among these contributions are "The Motor Truck in Central Asia" (January–February, 1921), "Scientific Work in Unsettled China" (May–June, 1922), and "Hunting Takin in the Mountains of Shensi" (July–August, 1922). Under the title of "The Extinct Giant Rhinoceros Baluchitherium of Western and Central Asia" Prof. Henry Fairfield Osborn

wrote for the issue of May–June, 1923, an account of one of the most important discoveries of the expedition, comparing the specimen with other rhinoceroses, living and extinct.

Beginning in 1922, a series of articles on the Third Asiatic Expedition appeared in *ASIA* Magazine as follows: by Mr. Andrews, in 1923, "Setting out for the Buried Treasure of Mongolia" (April), "A Paradise for Dinosaurs" (May), "Untying Red Tape in Urga" (June), "Tenting in Lama Land" (July), "A Kentucky Derby in the Gobi Desert" (August), "A Fossil Hunter's Dream Come True" (October), "Winter-cooled Ardor for Fossils" (November); in 1924, "Where the Dinosaur Hid Its Eggs" (January), "The Lure of Mongolia" (February); by Professor Osborn, in 1922, "Proving Asia the Mother of Continents" (September); in 1923, "Giant Beasts of Three Million Years Ago" (September).

In addition to these popular articles and those in the illustrated weeklies of England and France, the Third Asiatic Expedition has issued a series of twenty-two scientific papers, including the first scientific notices of important discoveries of new species of fishes, amphibians, reptiles, birds, and mammals in China, and of new genera and species of extinct animals in Mongolia. These papers by various naturalists and geologists—Nichols, Andrews, Bangs, Fowler, Granger, Berkey, Gregory, Osborn, Allen, Mook, and Matthew—have been published chiefly in the American Museum *Novitates*, of which copies may be secured from Dr. R. W. Tower, librarian of the Museum.

The geological work of the expedition has been presented also in papers read before the Geological Society of America at its thirty-sixth annual meeting in Washington, D. C. On this occasion there were presented a joint article by Prof. Charles P. Berkey and Mr. Frederick K. Morris on "Basin Structures in Mongolia" and a paper on the "Physiography of Mongolia" by the latter author.

Finally, to sum up the great results of the expedition in worthy form, there is in preparation a series of demi-quarto volumes under the title *Mongolia—Its Past History*, the first volume of which, *Geology and Geography*, will go to press during the present year.

Living Animals of the Gobi Desert[1]

By ROY CHAPMAN ANDREWS
Leader of the Third Asiatic Expedition

IN the last decade exploration has assumed a new aspect. The great geographic land areas, with the exception of certain regions surrounding the North and South Poles, have been visited by white men, and their topographic features more or less perfectly described. The new era of exploration concerns itself with intensive work in the little-known areas of the world, in order to make them known scientifically and economically. Other expeditions have done work of this character but I believe that the Third Asiatic Expedition is unique in the fact that it was composed of a group of specialists in various branches of science, *all of whom were concentrating their efforts upon a single problem.*

The great object of the Third Asiatic Expedition was to test the theory of the central Asian origin of the mammalian life of Europe and America. It was concerned with no department of science which did not bear directly upon this problem. Palæontology, geology, geography, and zoölogy were represented by the staff of specialists during 1922 and 1923.

In this issue of NATURAL HISTORY other members of the expedition are giving reports on their special lines of work, and it is left for me to present a general view of the zoölogy, which was my particular concern. Reptiles, batrachians, fish, and mammals occupied the special attention of the zoölogists of the expedition. Studies and collections in these groups were made most efficiently by Mr. Clifford Pope, who is relating in an article in this issue his experiences on little-known Hainan.

It is the purpose of the expedition to make collections of reptiles and fishes in every province of the Chinese Republic, for no correlated work has ever been done in China in these branches of zoölogy, and the wealth of new material which Mr. Pope has obtained gives abundant evidence of what remarkable opportunities await us. Mongolia and the Gobi Desert have such a limited fish and reptile fauna that Mr. Pope confined himself to China, leaving to the other members of the expedition the task of collecting the few species that exist in the desert.

The extant mammals are extremely important in relation to the palæontology of Mongolia and to the existing forms in other parts of the world. Just as the fossils show that many groups of reptiles and mammals originated in central Asia and migrated to Europe and America, so do the living mammals indicate a similar trend. The Rupricaprinæ, or goat antelopes, are an excellent example. This group in a measure stands intermediate between the true goats and the true antelopes, and comprises five distinct genera. In Europe there is the chamois; in America we have the Rocky Mountain goat; while in Asia three genera still remain,—the goral, takin, and serow. Without doubt the chamois and the Rocky Mountain goat are migrants from the central Asian stock, one going to the west and the other to the east.

The wild argali, or mountain sheep, which reaches its highest development in central Asia, has sent migrants

[1]Except where specification is made to the contrary, the pictures accompanying this article were taken by Mr. J. B. Shackelford, the official photographer of the Third Asiatic Expedition.

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Members of the Third Asiatic Expedition in their encampment at Irden Manha in Mongolia. Those seated in the middle row are, reading from left to right, Mr. Walter Granger, palæontologist of the expedition, Prof. Henry Fairfield Osborn, Leader Roy Chapman Andrews, Prof. Frederick K. Morris, associate curator of geology and geography in the division of Asiatic exploration and research, and Mr. Peter Kaisen. The four white men in the group that is standing are, reading from left to right, Mr. C. Vance Johnson, motor expert, Mr. Albert F. Johnson, Mr. J. McKenzie Young, motor expert, and Mr. George Olsen, discoverer of the first dinosaur nest. In the foreground at the left are the three Mongol interpreters, two in skull caps and the third (at the extreme left) with his queue encircling his head. This individual, named Tcherim, was the best hunter connected with the expedition. It is interesting to note the more robust build of the Mongols in contrast to the more slender stature of the Chinese. Among the latter is Buckshot (the young man toward the center of the front row with hair brushed back), Huei (seated to the right of him), Chow (the Chinese on the left of Buckshot), and Chi (standing under the tip of the flag). These are referred to in Mrs. Granger's article in this issue. Buckshot and Liu (at the extreme right of the upper row) are now employed in the American Museum. The photograph is included by courtesy of Mr. Walter Granger

through Siberia to Alaska, and southward into the Rocky Mountains and some of the coastal ranges. The American caribou and moose are certainly migrants from Asia, being very closely related to the reindeer and moose of Europe and Asia. Our American wapiti probably came from the Asiatic stock, which may have given rise also to the red deer of Europe.

I have mentioned only a few examples of the large animals which are familiar to every sportsman, but my remarks apply also to less-known smaller forms. It is evident that if we are to understand the past life of central Asia in its relation to the rest of the world, we must know the existing mammals as well as the extinct. Only by making extensive collections which will be available for study can this knowledge be acquired. The

Although yielding preëminence in speed to the antelope, which can beat an automobile going at forty miles an hour, the wild ass is one of the speed marvels of the desert, and combines with its fleetness an endurance that would make it a coveted draft animal if its wild nature did not preclude the possibility of its being domesticated.

To maintain an average speed of thirty miles an hour for sixteen miles calls for extraordinary reserves of energy, yet that was the record made by a stallion which was pursued in an automobile. The pictures reproduced herewith give an impression not only of the gaits of the animal as it exerts itself to escape the strange hobgoblin of metal that keeps relentlessly close to it, but also of the open country it inhabits, the sparse vegetation of which furnishes, one would imagine, all too little nutriment for so virile an animal. The photographs are controlled by the American Museum of Natural History and *Asia* Magazine

Asiatic expeditions have already obtained nearly 10,000 mammals, many of them representing species which are new to science. These are by far the largest collections that have ever been made in Asia, and many of the species composing them were taken in regions which have never before been visited by a zoölogist. Although the great majority of the specimens will be kept purely for scientific study, others will be mounted for exhibition in the new hall of Asiatic life. The groups to be constructed will have a geographical

as well as a zoölogical value, because typical scenes in the deserts, mountains, grasslands, and forests of Asia will be selected.

The superb collections which have been presented to the American Museum by the Faunthorpe-Vernay Expedition will give us an unequalled opportunity to illustrate groups and single specimens representative of the vast area of India and southern Asia. Therefore, the Third Asiatic Expedition has concentrated its efforts on China and central and northern Asia.

One of the groups for which material is already in the Museum will be called the Gobi Desert Group. This will show the Mongolian wild ass (*Equus hemionus* and the Gobi gazelle (*Gazella subgutturosa*). Although wild asses are found also in Africa and Thibet, very little was known about the Mongolian species until our work in Asia. We found these animals in considerable numbers in the central Gobi and extended the known range of the species several hundred miles to the east.

They are splendid beasts, about the size of a Mongolian pony, standing thirteen hands in height. They represent a wonderful adaptation to life in the desert, being able to maintain themselves on the scanty vegetation of sage brush and thorn bushes, which would not seem to furnish nourishment enough to keep a wooden animal from starvation. Much of the starch in their food is converted into water in the stomach, so that they seldom have to drink. Although we camped for five weeks on the banks of the Chagan Nor, a lake of considerable size in the center of the Gobi, we saw no evidence that the wild asses were accustomed to come to the water, and, indeed, they were found in greatest abundance in parts of the desert where there is no water whatsoever. During the months of July and August, when we studied them particularly, they were in herds composed largely of females and young, with one or two adult males. Very

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Fagged out by pursuit, the wild ass acknowledges itself beaten. Somewhat later, however, refreshed by a rest, it galloped off to join its fellows in the desert

often we would find individuals living alone and almost invariably these proved to be stallions.

The young are born during the end of June and the first part of July, and are able to run with their mothers almost immediately. We captured one baby wild ass, which was only three or

A baby wild ass and the one individual toward whom the little animal was really friendly. Photograph controlled by American Museum of Natural History and *Asia* Magazine

four days old; he was not able to keep up with the herd, so that we had no difficulty in overtaking him with the car. We kept the little fellow as a pet for six weeks, and had hoped to be able to bring him to America and place him in the New York Zoological Park, but owing to the impossibility of obtaining proper milk, he died at the end of six weeks. I have never known an animal so difficult to tame. He became really friendly only with Buckshot, the Chinese boy who fed him daily, and would have nothing to do with the other members of the expedition, although he received the greatest kindness from everybody.

I have been asked by many people if it would be possible to catch wild asses when they are young and use them for breeding purposes. I do not believe that this would be practicable, due to the extraordinary wildness of the animals. Certainly, it would be difficult to tame an adult wild ass.

Their speed and endurance is almost beyond belief. One fine stallion which we followed in the motor car while obtaining photographs and motion picture film, maintained an average speed of thirty miles an hour for the first sixteen miles of the race. He reached forty miles an hour in short dashes when crossing in front of the motor car.

After many experiences in chasing these animals, we came to the conclusion that all wild asses can exceed thirty-five miles an hour, but that only a few can attain a speed of forty miles even for a short distance. When the young are two or three weeks old, they can run almost as fast as the adults, but their endurance is not so great. Like all the animals of the plains, the wild asses evinced curiosity rather than fear when they saw a motor for the first time. They would invariably try to cross in front of the car, and it was only when they discovered that it was impossible to get away from their pursuer that they became thoroughly frightened. We usually found the Gobi gazelle associated with the wild ass, and whenever a chase was begun, gazelles would appear seemingly from nowhere, and we would have herds of both animals running in front of us.

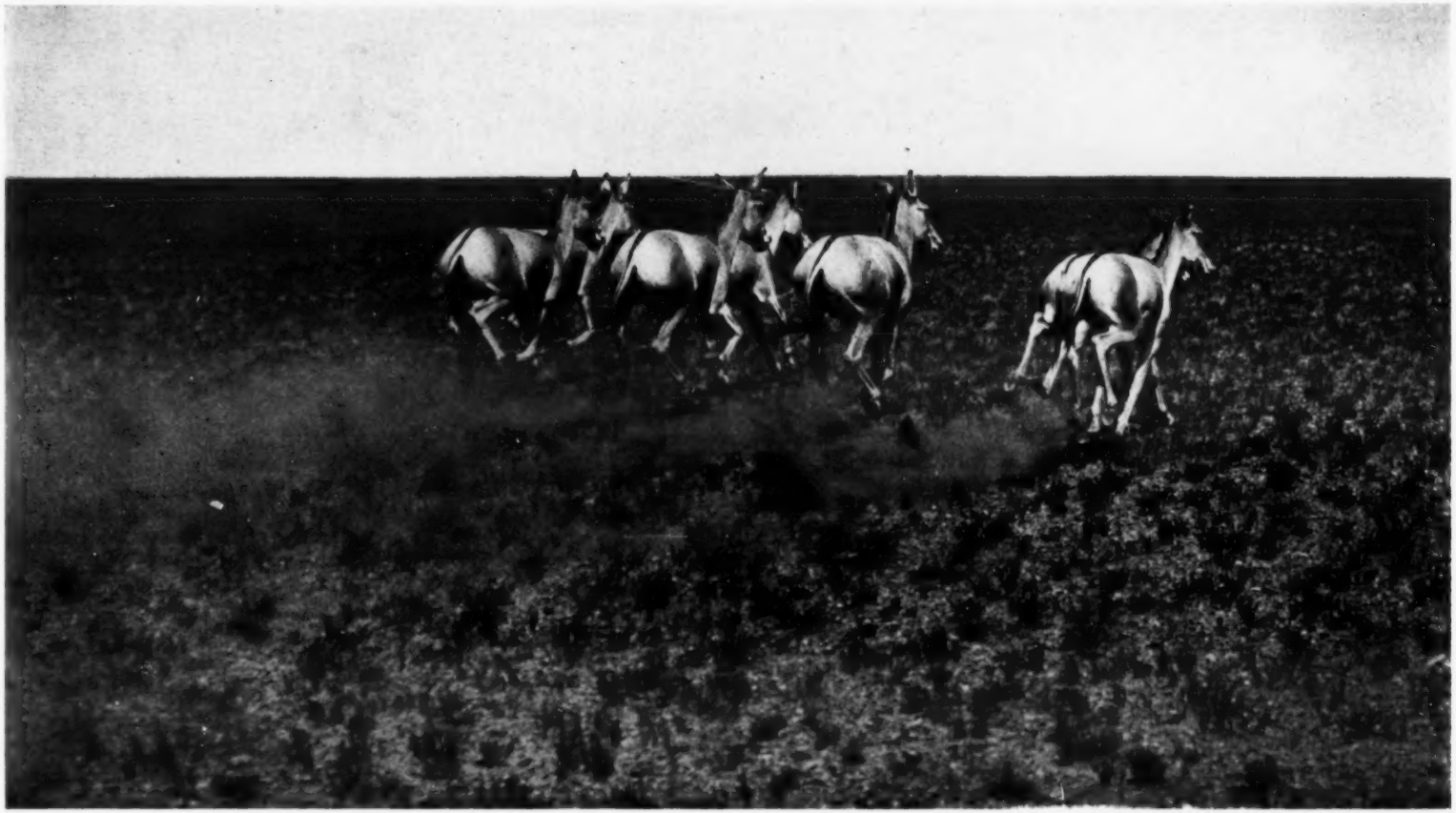
The gazelles are extraordinary creatures. Their speed is incredible and, after repeated demonstrations, we all became convinced that they actually can reach a pace of sixty miles an hour for a short dash. Mr. J. B.

This picture shows an antelope in repose. When in action this animal evidences a well-nigh incredible capacity for speed. On one occasion a herd made a semicircle about Mr. Andrews' car, which was moving in a straight line at the rate of forty miles an hour, and the speed of the animals, therefore, was probably not less than fifty-five or sixty miles an hour. The desert species never gathers into great herds but its relative of the plains may form aggregates consisting of thousands of individuals. Photograph controlled by American Museum of Natural History and *Asia* Magazine

Shackelford, the official photographer of the expedition, and I followed a splendid buck for ten miles on a chase straight across the plains. At first the animal easily ran away from us, although the car was traveling at forty miles an hour. After three miles, we began to overtake him and the last seven miles he maintained a steady speed of forty miles an hour. This was as rapidly as the car could go, and how much faster he could have traveled, we cannot tell.

The Gobi gazelle (*Gazella sub-gutturosa*) is a fine-limbed, clean-built animal and is entirely a desert species. On the grasslands lives the Mongolian gazelle (*Gazella gutturosa*), which has very different habits. It seems not to be able to exist on the dry and sparse vegetation of the desert, but is found in great numbers on the grasslands of Inner Mongolia and those just south of the northern forests. During the spring, immediately before the young are born, the Mongolian gazelles gather into enormous herds, composed entirely of females. These may include as many as six or eight thousand individuals—in some instances even more—which travel slowly to the flat plains, where they disperse.

On the great plain near Turin during the summer of 1919, my wife and I saw one of these enormous herds and a few days later the plain was alive with baby antelope. As we rode along on our ponies, the little fellows would jump up in front of us and go bobbing away like rabbits. We would often see them lying flat upon the ground, with their necks stretched straight out and their long ears drooping, and in this position they would remain absolutely motionless until they were certain they had been discovered. Even when only a day or two old, the babies can attain a speed of twenty-five miles an hour, as we demonstrated many times by following them in the car. Their greatest enemy is the wolf, and speed is their only protection. Almost as soon as they are born, they must be able to outrun the wolves, and the mothers select the flattest part of the open plains so that their babies may not be ex-



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SEVEN MASTERLESS STEEDS OF THE DESERT

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AN ANTELOPE DOE EXTENDING HERSELF IN FLIGHT

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THE DOG OF MONGOLIA

No animal is so dreaded in Mongolia as the dog. In a country where the dead are exposed instead of being buried, these animals acquire a taste for human flesh. They are savage and fearless, and not to be trifled with. Photograph by Mr. Roy Chapman Andrews

posed to the crafty approach of a wolf under cover. Wolves, by the way, cannot reach a higher speed than thirty-five miles an hour and can only maintain this for a very short dash.

When the expedition was returning to Peking last September, we saw half a dozen great herds of antelope. In one there appeared to be at least ten thousand individuals, both bucks and does. The Mongols told us that these herds would remain intact until late in the fall, when the mating is over. Apparently the desert species, *Gazella sub-gutturosa*, never gathers into great numbers, probably because there is no region of the desert which would provide sufficient food.

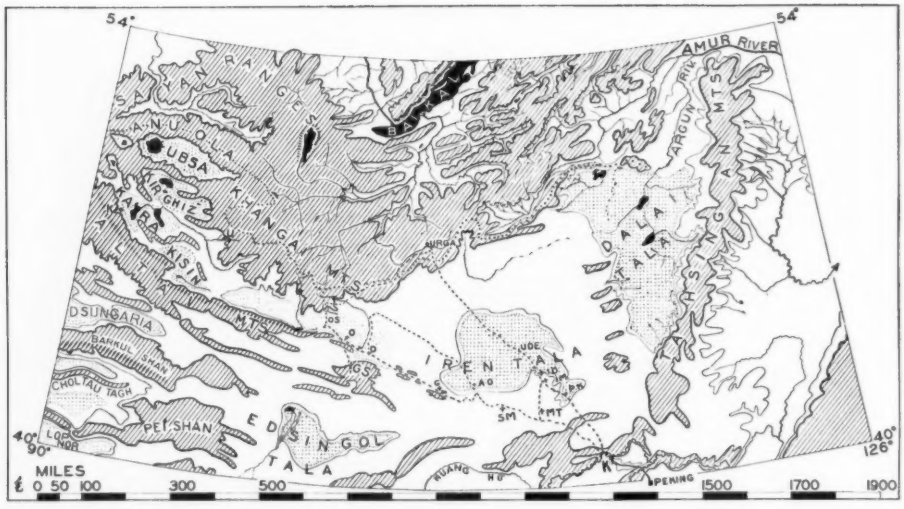
On the Altai Mountains we had the unique opportunity of seeing argali, or mountain sheep, and ibex on ranges where no white men had hunted before. Both these animals were in great abundance and we obtained a splendid series for groups that will be installed in the new hall of Asiatic life. During the summer the male sheep and ibex retire to the highest peaks, leaving the females and young to carry on their lives alone until the mating season about the middle of September. Although the argali reach enormous size, some of them having horns 20½ inches in circumference at the base, and more than 60 inches in length on the curve, such individuals are by no means common. During last summer I suppose we saw at least two hundred argali in a single locality but not more than ten or fifteen of them had horns more than 50 inches in length.

The Mongols hunt both sheep and ibexes continually and the result is that the animals are always wary. The ibexes, which are true goats, are among the most difficult to kill of all mountain animals. Not only are they hard to approach but they are so tenacious of life that if a bullet does not reach a vital spot, it means a long chase for the hunter.

The expedition has not as yet reached the country inhabited by wild camels, wild horses, and the rare saiga antelope. Wild camels were reported from a place in the desert about one hundred fifty miles from where we shall begin work in the summer of 1925. They live in a sandy region and it is doubtful if we shall be able to follow them in the motor cars as we have been doing in the case of antelope and wild asses, but other means of hunting them will be devised. The wild camels are very similar in appearance to the domestic two-humped Bactrian camels of Mongolia but are somewhat smaller. The wild horses are only about one hundred miles to the west of the region where we shall begin work, and doubtless the expedition will have little difficulty in obtaining specimens of them. The extraordinary saiga antelope—an animal with a great wrinkled Roman nose—lives in the west, not far from the habitat of the wild camels. It is one of the most grotesque of living animals and also one of the rarest in museums. We are hoping to be able to obtain a complete group for the new hall of Asiatic life.

In this short article it has been possible to mention only a few of the more interesting large mammals of Mongolia but in China proper there are dozens of others which will find a place in the Asiatic hall. Group material and study collections of mammals, reptiles, batrachians, and fish are being obtained with such rapidity and completeness that already the American Museum holds a unique position in the field of Asiatic zoölogy.

acquire a taste for human flesh. They are savage and fearless, and not to be trifled with. Photograph by Mr. Roy Chapman Andrews



Map of the basin regions of Mongolia.—Mountainous areas are shaded with slanting lines; the great lowland regions are white, and the deeper depressions, called *talas*, are stippled. The still smaller sedimentary basin units, called *gobis*, are located mainly within the *talas*, but are too small to be indicated on a map of this scale

Geological Reconnaissance in Central Mongolia

By CHARLES P. BERKEY
Chief Geologist of the Third Asiatic Expedition

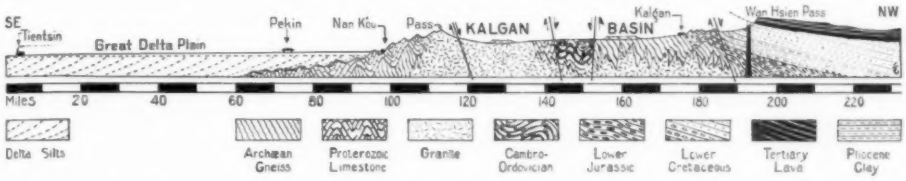
PRIOR to the reconnaissance undertaken by the Third Asiatic Expedition the geologic story of Mongolia was almost wholly unknown,—not because the region was beyond reach of observation, but because both those who lived there and those who had traversed it had not seen the significance of its features. Mongolia is not all a wild uninhabited impossible desert; on the contrary, large areas are as beautiful plains country as the arid regions of the world afford, and primitive peoples have roamed over its great open spaces ever since man began to migrate.

This country lies athwart the great routes of trade connecting centers of early civilization, and from earliest times to the present there have been travelers and traders, adventurers and messengers, caravans and expeditions crossing and recrossing this very region that is still largely unknown. Some have been collectors in search of any

Key map of Asia.—The area in solid black is that of the basin regions of Mongolia, shown in detail in the map at the head of this page

rare or new thing; some have been hunters in pursuit of sport; some have been restless souls simply in quest of adventure. Occasionally in recent lay out an exploratory traverse deliberately into a region of such reputation.

But to the geologist there are no hopeless regions. Wherever rock is to



Cross section from Tientsin to the Wan Hsien Pass above Kalgan.—The section is designed to emphasize the step-like approach to the Gobi region from the plains of China. With it is indicated something of the underground geologic structure and the relation of the principal rock formations. These fall naturally into three groups: (a) a simple delta, made of sand and clay built out into the China Sea; (b) complex rocks emerging from beneath the delta silts at Nan K'ou, and continuing a little way beyond Kalgan; (c) the gravels and sands, capped with basalts, at the Wan Hsien Pass. It is particularly noteworthy that the uppermost formations of both the plains of China and the plateau of the Gobi are simple sediments that lie unconformably over a floor of much more complicated rock

times exploratory expeditions have gone out, nominally for scientific investigation,—actually, in some cases at least, to make military and economic observations.

Thus, after untold centuries, in a land not new but old, in a land not isolated except by its own immensity and barrenness, virtually everything is still unknown, and one may project, as was done by the Third Asiatic Expedition, a traverse of three thousand miles, and not touch a single spot the scientific story of which is known.

It was common report that the desert countries of central Asia were particularly unpromising ground for geologic exploration. Caravans crossing the country found what was to them a wearisome stretch of wind-driven sand, and travelers returned almost exhausted by long weary months of toilsome journeying. It is not surprising, therefore, that the verdict of even the best-informed was that "the Desert of Gobi is a hopeless place," and it took some courage to be seen or the surface of the earth has features, there some sort of story is to be read, and there the desolate aspect of the present day may be but a passing phase in a succession of greater events. So in the face of discouraging advice, and in full appreciation of the nature of the task, the expedition set out to lay a line of geologic observation across the Desert of Gobi and bring back, if possible, the major secrets of its story. A region of such intimate relation to the historic and prehistoric migrations of man and beast ought itself to have an important contribution to make.

What was promised can be told in a word; what was found we shall probably take years to explain. In one year central Asia has become one of the great fields of geologic research and central Mongolia is already classic ground.

Under patient study the sands of the desert have resolved themselves into strata with definite structure and a long story of changes, while their fossil

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Nan K'ou Pass, with the Great Wall.—This is the place marked "Pass" in the cross section on the preceding page, and shows the rugged country of the southern barrier, just before the level Kalgan basin is reached. Photograph by Roy Chapman Andrews

content makes it possible to populate this barren-looking waste with as strange an assortment of living things of former time as this earth of ours has ever produced. The desolations of the desert are softened by the hand of Time, whose course we shall follow backward to the paradise of long ago.

APPROACHING MONGOLIA

The most effective approach to the region is from the plains of China, low-lying, monotonous, just barely above the sea. There the great rivers of China,—the Yangtze and the Hoang-ho, coming from central Asia, have been engaged for ages in carrying sediments from the plateaus and mountain ranges of the interior to the bordering plains below. And there they have slowly dispossessed the ocean waters and, in the course of time, have built all this flat country lying between the mountain uplands and the Yellow Sea.

Here and there a hill or a mountain ridge rises out of the plain, as an island would stand out of the ocean. They are indeed islands, surrounded now by the sands and silts of the plain where of old the sea lay at their feet. Beyond them the same low plain, with the same monotony, continues.

Farther inland, beyond Peking, one comes abruptly to a mountain barrier looming high above the plain, as if a great broken block of the earth had been lifted there to bar one's progress. This is, in fact, about what has happened, as one who looks closely may see, although the reason for it is not so simple. It is here that the great wall of China was built, doubtless to add still greater difficulty to the passage of this natural barrier. But at Nan K'ou Pass one may climb to a new level lying beyond, two thousand feet higher and almost even with the tops of the frowning mountains. And then on this higher level one finds himself again on a plain, though a much smaller one, a broad open country through which one runs half a day by rail to Kalgan. Here, as abruptly as at Nan K'ou, a new escarpment, even more formidable

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THE RUGGED COUNTRY OF THE NORTHERN BARRIER, WITH THE OUTER GREAT WALL NEAR KALGAN

This picture was taken fifteen miles south of the Wan Hsien Pass (shown on p. 161) on the borders of Mongolia. Photograph by Charles P. Berkey

than the other, stands across the course. Here other and still more primitive walls mark the efforts of Chinese civilization to protect itself from the invaders of the desert.

If one is to go farther into Asia, it is necessary again to toil over the passes of the new barrier. When this is done, one finds himself not on a mountain range at all, but on the edge of a great plateau 5000 feet above the first low plains of China and the sea; and now for a thousand miles one may go forward without encountering another such barrier. This is the outer rim of one of the great interior basins of central Asia,—this is the border of Mongolia, the edge of the Desert of Gobi.

Profile across the Great Basin of the Gobi from Kalgan to Urga.—The base line is sea level. The profile itself is founded on nearly 1000 altitude readings reduced to scale, so that the vertical measurements are exaggerated ten times over the horizontal. At the south, the Pacific divide at Wan Hsien Pass (see map on p. 161) stands at about 5000 feet, and parts the waters that flow into China from those that flow into the desert basin. At the north the Arctic divide stands at about 6000 feet, and parts the waters that flow northward into Siberia from those that flow southward into the desert. Between the two divides lies a great cradle-like sag, descending gradually to the depression at Iren Dabasu, where the elevation is not much more than 3000 feet. This is the Great Basin of the Gobi

PHYSICAL FEATURES OF THE GOBI

It is comparatively easy to give a mental picture of the essential features of the great basin region of central Mongolia, to the edge of which we have now approached. The Gobi is only one of a series of great basins, all of semi-desert character, which together stretch across the continent of Asia. It is the easternmost and the largest of them.

As one stands on the edge of the plateau and turns toward the Desert of Gobi, the view is entirely transformed. Instead of rugged country, deep valleys, mountain barriers, and difficult passes such as have been encountered in reaching this land, one looks out over a great rolling plateau. It gives a curious impression of endlessness, and this picture from the edge of the escarpment sinks into one's soul. It will steal into the mind over and over again, even though one be hundreds of miles from the region, making one feel quite unaccountably that this land is the veritable roof of the world and that a little way ahead, just beyond the next rise of ground, one must be able to look over the edge and see the rest of the world spread out before him.

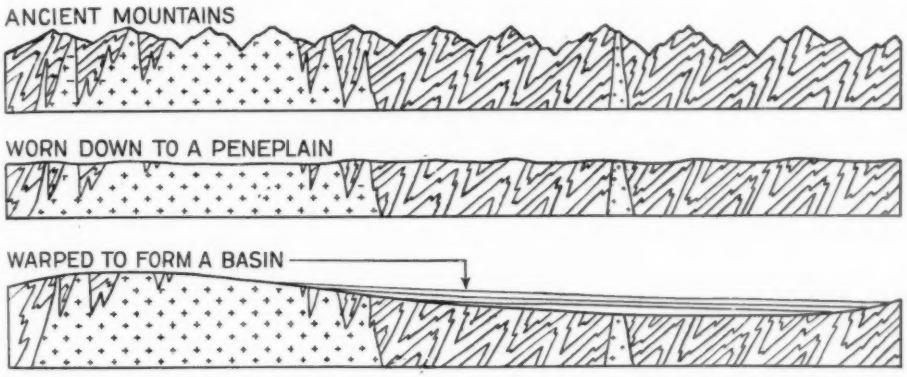
It is not as endless, of course, as it appears to be, but as far as one can see, and indeed for hundreds of miles beyond, it is a gently rolling, open country, with stretches of level, monotonous plain between other stretches with more variety of relief. Here and there hilly country or a mountain ridge replaces the flatness, but this is certain to be succeeded only a little way beyond by the gently rolling or level, monotonous plain.

Thus, the trail stretches over hundreds of miles of desert to the mountain divides of the north, which separate the wooded Siberian slopes from the desert basins of central Asia. From all sides these lands slope to the interior.

Central Mongolia is truly a basin. It is 2000 feet lower in the central portion than on its uplifted margins. But it is nearly a thousand miles across, and on such a scale its basin form is not at all apparent. Such streams as there are now, behaving just as other more ancient streams have behaved for ages past, flow out into the basin, whenever they flow at all, losing most of their waters as they go, either by evaporation or by sinking into the sand. Here and there a trickle struggles bravely through to some salt lake, but for the most part there is no surface water.

This large, basin-like region is itself a complex of smaller basins, each one of which is marked by a smooth, flat, level surface and is separated from its neighbor basins by rolling hill country or by semi-mountainous ridges. These secondary basins, with their great open stretches of level ground, some a hundred miles across, are characteristic of the region. Such an open, smooth plain is called *gobi* by the people of Mongolia, and this is the name that has now come to be applied to the whole desert region of central Mongolia, the Desert of Gobi.

Across this bare, open, unprotected plateau region fierce winds seem to blow interminably. Dust is swept entirely away to settle down again in distant regions, while the heavier sands, formed by the disintegrating action of the weather on exposed rock ledges, accumulate near by in dunes. Great quantities of the lighter material must have been swept off the Gobi and carried to the lower border lands of China. Other great quantities of sand shift about over certain tracts of the desert, making travel slow and difficult.



This diagram is intended to illustrate successive stages in the development of a Gobi basin. The upper section shows the complex structure and rugged profile of the original land, the second indicates the effect of erosion in wearing this ancient land down to a peneplain, and the third illustrates the development of sedimentary beds of still later date on the down-warped portions, after the region had been lifted and warped into basins

Thus it happens that such rain-wash erosion as there is, together with the work of the wind, has swept from the rock floor almost everything that in other countries would have made a soil, and one may travel mile after mile and day after day over the nearly barren surface of the rock formations that make up everywhere the solid "crust of the earth." True it is that

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Typical rock desert along the Urga caravan route.—The floor is solid rock, and is virtually bare. Residuary boulders of granite lie scattered about, left by the disintegrating action of the weather. There isn't an inch of real soil under the wheels of the motors. Photograph by Charles P. Berkey

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The far-flung landscape of the Gobi.—A characteristic view in the center of the desert, looking across a sediment-filled basin. These are the boundless plains that impress one so much on the plateaus of central Asia. Photograph by Walter Granger

there is much drifting sand, so abundant in certain belts that it is impossible to cross successfully except with camel caravans. For the most part, however, the Gobi is not strictly a sand desert. In all essential respects it is a rock desert, with the underlying geologic formations so near the surface that one trained to see such things is not confused by the thin veneer of sand. Looking through this he soon learns to unravel the underground structure, and read, with as much success as in other regions, the geologic story that is hid away in the strata beneath.

GEOLOGY OF THE GOBI

One soon learns, for example, that the rolling, hilly, and mountainous portions of the country dividing the Gobi plains are underlain by complex, comparatively ancient rocks, and that the smooth, level, monotonous stretches between are underlain by much younger sediments with much simpler structure and a very different story. Together they must carry the secrets of the geologic history of central Asia. If these strata do not, then it must be that the story is lost.

Thus the geologic formations of Mongolia consist of two grand divisions,—one an exceedingly complex series of ancient rocks carrying the story back to the very dawn of geologic history, the other a simple series of sediments recording the last chapter.

The older story is much the longer and more complicated one, involving foldings of strata and upheavals into mountains, outbreaks of volcanoes and igneous activity in the ground below, the sinking of lands beneath the sea and their emergence again, followed by the making of mountains a second or a third time, only to be destroyed in turn like those before them. To tell this as it should be told is much too long a story for the present purpose. It must suffice to catch merely a glimpse of these mighty movements reaching back farther and farther into geologic time.

Between this ancient series and the later one a long interval is lost. Everything since that remote time is simpler and easier to read. The continent has been more stable. Strata formed since then are little disturbed, and tell a clearer story. They lie on the upturned edges of the older series, and form the smooth plains of the Gobi.

Our immediate interest is directed particularly to these level *gobi* areas that we have now discovered are underlain by simple sediments of later date. It is quite worth while for us to find out how these sediments are related to the more complicated rock formations of the hilly districts forming the divides and to determine whether either of these formational groups carries minerals of value or fossils of scientific interest, or evidences of any kind that will help us to unravel and understand the whole geologic story.

For this purpose there is little promise in the smooth level tracts of unbroken plain. But not all portions are so monotonous,—not all of the plains areas are unbroken. Here and there, in former times, streams have cut down into the deposits, and have scooped out valleys across the plains, and gulches have been carved that still remain as evidences of former erosion conditions. If one stops, therefore, at such a place on the margin of an old valley, one may find the edges of the strata exposed, and these beds can be inspected one after another. One has, therefore, occasional opportunity to see not only what these sediments are and

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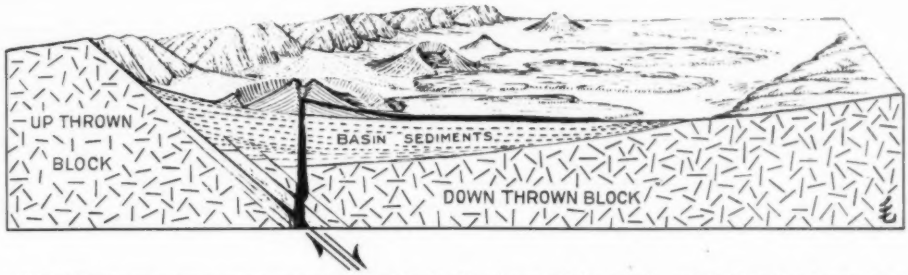
Horizontal strata in one of the Gobi basins, where erosion has exposed the edges of the sedimentary beds as effectively as if one had dug trenches through them. Such places as these are the normal hunting grounds for fossils. Photograph by Walter Granger

how one layer differs from another, but also what they carry. Still more rarely erosion has cut through to the very floor, exposing the underlying basement rock on which the sediments were originally laid down, and one can then see that this basement, or floor, is the same complex of older formations that was before noted in the rolling divides between the basins. Everywhere, therefore, there is this complex old floor that was once a land surface itself, until changes took place that permitted some of it to be covered with later sediments. At such places the character of the bottom sedimentary beds can be seen and, if one's search is continued far enough, other and higher or younger beds will be seen. If conditions are particularly favorable, it may be that nearly every individual stratum in the whole basin can be thus examined at one place or another. By piecing together bits of evidence, then, from one outcrop after another, it is possible to formulate the essentials of the whole story of the basin sediments and to determine what relation this story has to the much more complicated one of the still more ancient floor.

This is a part of the story,—almost the closing pages of it. Long before the Age of Mammals, doubtless many million years ago, northern Asia had been worn down, chiefly by the slow work of stream erosion, to the monotonous relief of a peneplain (a low erosion plain). In still more ancient times, it had been three times at least a mountainous continent; but the steady wear of weather and rain, of wind and water acting through immensely long intervals of time had destroyed these mountains and carried off their waste and had carved out a new plain of its own design across the complicated rock formations that then made up the structure of the continent. This was accomplished almost as perfectly as if one had taken a great knife and had pared the continent down, throwing

the shavings into the adjacent sea. Thus the mountains were sliced off, but one can still see the complicated structures of the roots of them in the rock floor of the present desert and beneath the sediments of the basins.

At that time the continent may not have stood very high above sea level, but at a certain stage some powerful internal earth forces caused the continent to be lifted higher and higher above the sea to something like its present position. In the course of this movement it was raised more at the margins than in the middle, and it was warped enough so that it took the form of a great shallow basin. This warping was not very uniform either, so there came to be small basins within the larger one.



This diagram represents a rectangular block sliced out of the earth, exhibiting the features of a warped and faulted basin. The front of the slice shows the cut edges of all the rock structures. The center of the slice is the down-sinking area, and here the sediments have accumulated. A split or fault has developed near the left-hand end, and the old crystalline rocks are heaved up, making a long straight mountain front. Volcanoes have broken out along this fault zone; the foremost volcano is pictured sliced in half, exposing bedded ash and lava flow. A breached cone stands farther away along the same zone and two perfect cones are seen in the distance. New sediments are being carried down from the uplifted block by streams, which are depositing their load in the form of alluvial fans on top of the previously formed lava flows. In time these sediments will form a new series of overlying strata

Then the rivers that had aforetime flowed to the sea began to flow inland, into the basin which had been made where previously there had been outward-sloping upland. And the sediments that these streams carried were now deposited in the basin instead of being borne to the sea. Sands and gravels and muds were laid down there, year after year, age after age, until the smaller basins were filled and united with their larger neighbors, to make a still more extensive cover of sediments. These are now the strata that lie on the old rock floor, and this in a word is the origin of the "later sediments" that lie beneath the *gobis*.

At times in the course of this process new warping took place, making still greater unevennesses, developing new basins where there had been none before, deepening some that were not so deep before, and lifting up places that had been level before. Then the work must begin all over again. Uplifted places where sediments had already been laid down were thus exposed and eroded, so that these beds were destroyed almost as soon as they were made, and the erosion débris was carried off to fill in the adjacent, newly formed depressions.

Not infrequently an area that had thus been the seat of deposition and had subsequently been uplifted so that its sediments had been in part removed,

found itself later, after another change, the seat of deposition for a second time. Thus there are often exhibited two or three series of sedimentary beds, one on top of the other, with erosion intervals between. Streams sometimes cut deep channels into these new deposits, uncovering their internal structure, showing up their peculiarities of composition and their evidences of changes of level or of shiftings of centers of deposition.

Sketch of the range Baga Bogdo, one of the Altai chain, seen from the north at a distance of forty miles. It is a fault-block mountain, like that shown diagramatically on p. 169. In this view we are looking southward at the steep front face of the block, which rises to 7000 feet above the floor of the basin. The remarkably even sky line, sweeping gently up from either end to the highest peak represents one of the ancient peneplains, carved upon hard rock, and now uplifted. In the broad basin of the foreground lie several thousand feet of sedimentary strata, some of which have proved to be veritable treasure houses of rare fossil forms. There are Cretaceous beds bearing dinosaurs, fossil fishes, and fossil mosquitoes; Oligocene beds carrying the monster *Baluchitherium*, and a Pliocene formation in which are the bones of horse, deer, and ostrich

In some places, also, earth disturbances were much more pronounced. Instead of gentle warping the floor was broken. On one side of the fracture the earth dropped down and the other side was lifted until it stood as a frowning escarpment. Of such deformations there are all grades, from a gentle warp that simply tilts the strata or a dislocation that displaces the strata only a little to great fault blocks uplifted till they stand as mountains. The fine north face of Baga Bogdo of the eastern Altai, standing majestically above the adjacent basin plain, is such a faulted block. It has been pushed up out of the plain at least 7000 feet above its former level, and for all we know the movement may still continue.

At many places where such movements took place, volcanoes broke out along fractures where there was considerable dislocation. One finds abundant accumulations of ashes and cinders, now forming beds of tuff, lava flows, and all sorts of intrusions of once molten rock. This complicates the story. Occasionally one finds old lava fields, covering hundreds of square miles, and, still more rarely, a volcano, so recent that the weather has not yet destroyed the gloss on the glazed surfaces of some of the rocks at the vent, where hot gases must once have poured out. But volcanoes are at best transient things. The loosely built pile is soon destroyed. So it happens that the old ones have been demolished and only the less destructible evidences remain.

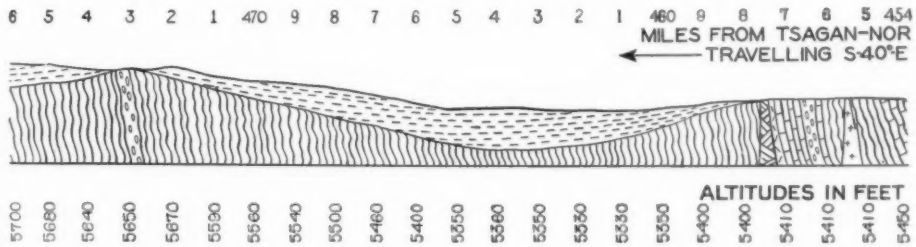
Such changes can be read from the structure of the rocks alone, but an added interest attaches to the sediments of the basins, because of the fact that these same strata carry fossil forms representing the living creatures of that time. The bones of the animals that roamed over the continent of Asia during the period when the deposits were being made were sometimes buried in them, and may be dug out again if one finds the places where they have been entombed. These places are the fossil fields of Mongolia.

One learns where to find them and how the strata of one field are related to others by unravelling the geologic story that interprets the ground.

METHOD OF WORK

But the story is to be read, if at all, only by most careful and painstaking work. There is no base from which to start—there is no map worthy of the name to guide one—and if there is to be an explanation, it must be built up from the ground itself. This requires constant watchfulness for every bit of evidence. During a few minutes of inattention one may pass by the best find that the region affords. One must make literally thousands of observations and inspections and judgments and trial studies as rapidly as it is possible to work. It is not an unusual thing to make a thousand examinations of rock outcrops in a day, and record their meaning in whatever way is practicable, considering the speed of travel imposed by the movements of the expedition. These records must be kept in a running account, so that they can be picked out again in their proper setting, and so that the succession of changes can be reproduced.

To this end a route map is kept, on which is sketched the course of the traverse and the bordering topography. From aneroid barometer readings, made with every change of level, a running profile is constructed mile by mile. On this the geology is sketched in cross section, representing as true to life as possible the succession of formations, the underground structure, and the interpretation of their relations one to another.



A page from one of the note books, showing a fragment of the 3000-mile geologic cross section made on this reconnaissance. This illustrates the method of representing certain geological data en route. The profile is constructed from aneroid readings; the underground structure is an interpretation based on the outcrops of rocks examined while driving over the surface. This particular section shows a portion of the eroded and warped old rock floor, once doubtless completely covered with sediments of later age, now uncovered again at its highest points by recent erosion

When the expedition is moving rapidly, such an undertaking is extremely trying and exhausting work. One must spend every minute, when the expedition can be halted, in examining the ground, while notes and sketches must be made largely on the move. One must jump out and examine an outcrop, or run to the top of a hill or collect a representative specimen or detect the presence of fossils or take a measurement and be off again, while the rest of the caravan moves leisurely on. Then one must drive all the faster to catch up if he can, making his notes like the wayfarer,—on the run! Several times more than a hundred miles of such cross section work was done in a single day.

Route studies covering more than 3000 miles have been made, and these form the basis of the related exploratory investigations, and of what is known about the distribution of the later sediments and other strata in the Desert of Gobi. Where a promising fossil find is encountered, there a longer stop can be made, and the geologist, for a time, turns fossil-hunter with the rest. But at the first opportunity he is off again to extend the section and locate new fields. Thus exploration for new sites and development of proven ground go hand in hand.

These route studies must be carried everywhere and must be kept continuous so that one does not find himself geologically isolated in a completely unknown country. But special local studies may be made wherever there are longer stops. These may take the form of joining in more diligent search for fossils or of engaging in a detailed examination of the succession of strata, or they may result in making a local geologic map as a method of recording more complicated data in a form suitable for reference and record.

If a locality proves to be particularly critical and productive, so that all interests may work together for a longer time, then a much more elaborate, special areal study is made of as large a surface as can be covered in the time. These special areal studies become the key maps, or standards of reference for future work, and the areas chosen for them are always selected because they give special promise of returns in unravelling the history of the region. At least 700 square miles were thus mapped in detail during the intervals of travel in the first season. It is such studies as these which really give the most reliable scientific returns, and without them the whole effort would be reduced to simple reconnaissance, because the moves of the expedition are made too rapidly to allow adequate checking of the more difficult and critical points. In these places, chosen for special study, the structure can be worked out in detail, the succession of strata with their fossil content can be much more exhaustively determined, and the geologic story can be pieced together with great assurance.

Altogether the task is an arduous one. The heaviest work comes when it would be much more convenient to ride along with the rest of the expedition and enjoy the scenery. It is one thing to bowl along for a hundred miles over a rolling plain, musing on the fortunes of the day or the fame of the morrow, and quite another to be responsible for the geologic record of the route and of the meaning of the ground over every mile of the journey. It is a severe tax on endurance, and on devotion to science, but the success of the enterprise is quite as much dependent on this kind of persistence as on any other factors.

If one has such work, it is physically impossible to record all of the observations and assemble them in presentable form during the day's operations, and as soon as camp is pitched, one must therefore retire to his tent and continue on the day's notes far into the night. Maybe exploratory work is attempted in a less strenuous manner, but it is not done that way if the responsibilities of the expedition are suitably cared for, and if the expectations of the men at home who vouched for it and who foot the bills are fully to be met.

There are few better places in which to sleep than the Desert of Gobi,—but

it does not fall to the lot of a geologist to take full advantage even of that opportunity. After the other members of the expedition have all turned in, the geologist must wait for the proper time, set up the instruments and "shoot Polaris," so that by means of the stars he may determine where this place is. After all of these things are done, little enough time is left for rest.

One gets his inspiration from the work, and from a belief that if it is well done, we shall by and by unravel the story recorded by the rocks, and the expedition will find what there is to be found.

If one has learned to interpret the meaning of the features to be seen, then, after these keys have been found, one can tell with considerable assurance where the more promising fields are and where, on the other hand, it would be wasted time to stop.

It is always a most satisfying thing to appreciate that the rock formations of the earth are just as they ought to be. This is because they have been made through processes and by agents and under laws that can be understood. If one can read his geology in these terms, and if one's interpretation is sound, the rock formations behave just as they are expected to behave, and they occur where they ought to be, and they carry what they ought to contain. Rest assured it is not because of any wizardry or supernatural competence in the investigator that the strata begin to reveal their secrets. And it is not because of any erratic or mysterious or accidental behavior of the earth or any trickiness or unreliability of the rocks themselves that mistakes are made. Their story is always there, and one must learn how to read it from the few scattered records still preserved in the only symbols that the earth knows how to write.

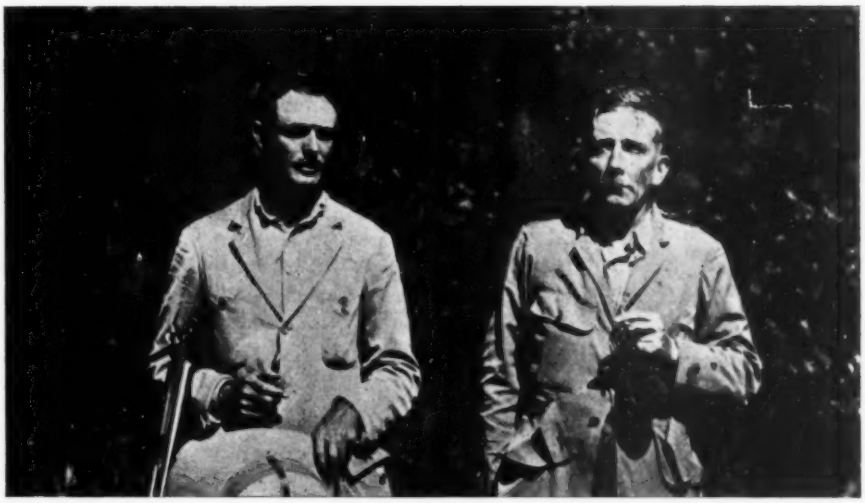
One reads this language, if he is an explorer, else he does not learn the story; and one follows these obscure pointers of the ground, otherwise its choicest treasures will not be found.

The earth does not respond to a whim. One may search blindly, to be sure, and make an accidental find. But it would not be to the credit of a scientific expedition to search in that way. One cannot make a discovery where there is nothing. And one should not seek where it can be shown that the earth has not produced. But if there are hidden treasures and if there is a new story and if it falls to one's lot to cross such ground, then one must not fail to find what there is to be discovered.

It is not good fortune alone that leads to discovery. Clairvoyance and magic will not do. Back of it all is a lot of plain hard work. Through it all runs a lot of vigorous discussion, an endless amount of revision of hypotheses and many a try out of new theories, many a ruthless rejection, and many an hour of groping thought. Fortunate indeed are they whose ground has been favored and whose final working hypotheses are true enough to solve their major problems and lead to contributions of real value.

A RHINO AND HER CALF

It is believed that this is the only photograph ever secured of the one-horned Indian rhinoceros (*Rhinoceros unicornis*) in a wild state. These two animals lived in a patch of thorn and bush cover near the camp established by the Faunthorpe-Vernay Expedition. They might easily have been shot, but only good specimens were desired and the horn of this female was poorly developed and her calf too small. Because the members of the expedition saw her again and again during their sojourn, they came to feel for her a familiarity that was untainted by contempt. They named her Lizzie



The leaders of the expedition, Colonel Faunthorpe on the right and Mr. Vernay on the left

Jungle Life in India, Burma, and Nepal

SOME NOTES ON THE FAUNTHORPE-VERNAY EXPEDITION OF 1923

By LIEUTENANT COLONEL J. C. FAUNTHORPE

Late Commissioner of Lucknow, India

THE PICTURES ACCOMPANYING THIS ARTICLE WERE TAKEN BY MR. G. M. DYOTT, THE PHOTOGRAPHER AND CINEMATOGRAPHER OF THE EXPEDITION

THE fauna of India have until now not been well represented in the American Museum of Natural History, and it was to remedy this deficiency that the expedition to India was undertaken by Mr. Arthur S. Vernay and myself in 1923. The specimens collected will be shown in the Asiatic hall, which is one of the additions to the Museum now being built.

A matter to which Prof. Henry Fairfield Osborn is devoting much attention is the deplorable rapidity with which the wild animal life of the world is being destroyed, and recent articles of his entitled, "Can We Save the Mammals?"[1] and "The Close of the Age of Mammals"[2] have attracted widespread attention. The almost complete disappearance of game animals in the United States is, of course, notorious, but the same thing is going on practically all over the world.

Sir H. H. Johnston, in his introduction to Schillings' book, *With Flashlight and Rifle in Africa*, draws attention to the "ravages of European and American sportsmen, which are still one of the greatest blots on our twentieth century civilization." He adds, "All the wrongdoing does not rest with the white man. The Negro or the Negroid, armed with the white man's weapons, is carrying on an even more senseless work of devastation," and "Public opinion should strengthen as far as possible the wise action of governments in protecting the world's fauna all the world over, wherever the creatures thus protected do not come into dangerous competition with the welfare of human beings. Moreover, it

[1] "Can We Save the Mammals?" by Henry Fairfield Osborn and Harold Elmer Anthony. NATURAL HISTORY, Vol. XXII, Number 5, pp. 388–405.

[2] "The Close of the Age of Mammals," by Henry Fairfield Osborn and Harold Elmer Anthony. *Journal of Mammalogy*, November, 1922.

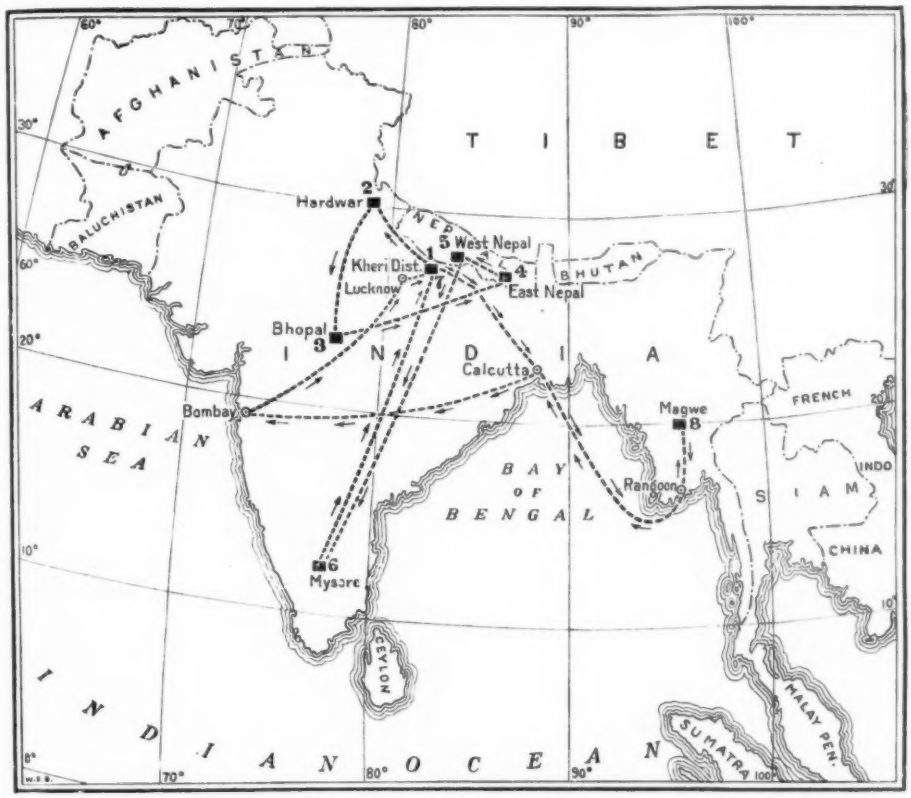
is for the welfare of humanity in general that this plea is entered. The world will become very uninteresting if man and his few domestic animals, together with the rat, mouse and sparrow, are its only inhabitants amongst the land vertebrates. Man's interests must come first, but those very interests demand food for the intellect." Schillings himself writes: "Already a great number of the inmates of our zoological museums have been struck out of the book of living things, though they existed in millions in the time of our fathers. The work of destruction entered upon by civilized man goes on with terrible swiftness. . . . To-day there is still time in the case of many species. In a few years it will be too late."

And the extermination of wild animals is not confined to Africa, nor to the United States, where it is already practically complete. Particularly since the introduction of the "Reformed" government in India, which has resulted in a generally slackened enforcement of existing laws and rules (the Arms Act and Forest Act among others), the dimunition of game, as I can state from my own personal observation, has been rapid. There are many more guns in the villages than formerly and I know many districts where game animals and birds, abundant not many years ago, have now practically disappeared. Within a measurable space of time there will be no game in India, except in preserves maintained by native chiefs and in the more inaccessible of the government forest reserves. And even in the government forests, the depredations of the Indian poacher are becoming continually more extended and at the same time are less resisted by the Forest staff.

It was the consideration of these facts which led the American Museum authorities to plan an Asiatic collection and to welcome the offer made by two Englishmen to provide the Asiatic wing, adjoining the Roosevelt hall, with a representative collection of the animals of the plains of India and Burma.

The idea of the Indian collection began as far back as 1918 when, owing to a disagreement with my superiors as to the proper administration of the branch of the Intelligence Department of which I was in charge, I left the Army in Flanders and went to New York on the British War Mission. One of my fellow passengers on the good old "Baltic" was Mr. Arthur S. Vernay, an Englishman who has been in business in New York for the last twenty years or more. Another was Mr. William Beebe of the New York Zoological Society, author of the well-known *Monograph of the Pheasants.* Through him I met Prof. Henry Fairfield Osborn, who showed me over the American Museum, including the taxidermy rooms. I was much impressed by the perfect system of taxidermy in use and by the artistic manner in which the animals were shown in groups in a reproduction of their natural surroundings, as well as being struck by the fact that the fauna of India were represented by very few specimens, and those of a very poor quality.

Later, on my return to India after a period of duty with the British Embassy at Washington, I wrote to Professor Osborn and offered to make a collection of Indian animals, if he would provide me with a capable taxidermist. Vernay came to India on a shooting trip shortly after this, and we discussed the matter, with the result that when he returned to America, it



Route of the Faunthorpe-Vernay Expedition to India, Burma, and Nepal, with the hunting areas indicated in solid black and designated by numbers showing the order in which they were visited

was arranged that a collection should be made. The Museum promised us a taxidermist, and Vernay, who not only has ideas but the energy and the means to carry them out, undertook to finance the expedition.

It was obvious that photographs and cinematograph films would add greatly to the value of the collection, especially as the American Museum makes a feature of lectures, illustrated by films. The Museum's educational activities with the schools reach yearly, I believe, about a million and a half people. The services of Mr. G. M. Dyott, F.R.G.S., as photographer and cinematographer to the expedition were fortunately secured. Dyott has done a great deal of exploration and photographic work in the wilder parts of South America, and during the War was a commander in the Naval Flying Corps and specialized in aërial photography.

Dyott had his first introduction to the Indian jungle when we were collecting specimens of swamp deer. Wearing a pair of rubber thigh boots (surplus government stores), he took station, with his movie camera, in about two feet of water to await the arrival of the deer, which we undertook to drive in his direction. Vernay having roused a fine stag, the line went off in a different direction, and the unfortunate photographer did not get his pictures until about three hours later. Although the leeches are rather active in those swamps, he made no complaint.

He was always ready "to take a chance on anything" in order to secure a good film. On several occasions he was posted on the ground when tigers were being beaten out of the thick growth, and twice, when in this precarious position, he secured an excellent film of a tiger galloping across the open, as well as "close ups" of elephant, rhinoceros, tiger, and many other animals.

I had arranged to have a shooting party in the Ranee of Khairigarh's jungles in the Kheri District at Christmas, and was fortunately able to secure Jonas, a taxidermist sent by the American Museum, in time for this. I was successful in obtaining fine specimens of that beautiful and rare animal, the swamp deer, as well as some other mammals and certain rare birds. It was a good omen for the success of the expedition that one of the two stags I shot carried very massive antlers, having twelve points and measuring 39½ inches, which is, I believe, a record for the province. It is certainly by far the best head I have ever seen.

Vernay and Dyott arrived early in January, and assisted by Turner, the Forest Officer of Kheri, and by Kunwar Dillipat Shah of Khairigarh, completed the swamp deer group, and secured some other specimens as well as good pictures.

The chief difficulty which confronted us was how to obtain groups of the maximum number of species in the short time available, for, owing to the extreme heat and the rainy season, shooting in the plains of India must practically cease by the end of May, and in Burma by the end of June. We had only about five and a half months in which to do our work.

The India Office and the government of India had already given their approval to the expedition, and the local governments and native chiefs provided generous help. The India Office persuaded the Indian government to place me on special duty (without pay) to assist the expedition for a period of three months.

After completing the swamp deer and the nilgai groups, Vernay made a special expedition into the lower range of the Himalayas on the Ganges to shoot a big tusker elephant which the year before had chased the Forest Officer and would undoubtedly have killed him had the officer not succeeded in scrambling across a nullah, which the elephant could not cross. It is curious, by the way, how small a ditch will prove impassable to an elephant. In the old days, in some of the forest divisions, deep and square-cut but surprisingly narrow, ditches used to be dug around the forest bungalows to keep the elephants out. I don't think an elephant can get over a six-foot ditch; one of seven feet will certainly defeat him.

This big tusker was, no doubt, somewhere in the neighborhood, but could not be located, which is perhaps not surprising considering the great density of the Sal Forest up north, compared with the forests in the Billigirirangan Hills in southern India, in which we got our elephants later.

The next place visited was Bhopal, where Her Highness the Begum and her ministers were most helpful, and Vernay was fortunate enough to secure a sambur stag with a massive and symmetrical head of 41-inches, and also specimens of the Indian antelope and gazelle. A 41-inch sambur is a fine trophy in these days.

I fear that game has become very scarce in Bhopal, as His Excellency the Viceroy, who visited that state

about the same time, and no doubt had the pick of the jungles reserved for him, did not succeed in securing a sambur.

While Vernay was hunting in Bhopal and elsewhere, I was continuing to do a bit of useful staff work (in addition to my ordinary duties of misgoverning the Lucknow Division) by arranging for future trips. The chief point was to get the specimens in the shortest time. This depended mainly on selecting the best locality and season for obtaining each species. Colonel O'Connor, the British Envoy to Nepal, had offered to help and very kindly asked Vernay and Dyott to join his tiger shoot in eastern Nepal, where Vernay bagged a couple of tigers and Dyott got some good films. The permission of the government of Madras was obtained to shoot one tusker and one female elephant, and the bison required for the group, in Madras Government Forest, and the Maharajah of Mysore allowed us one tusker elephant in his territory.

Our object was to obtain a group of each animal. For instance, of the bison—one bull, one cow, and one calf; and, in addition to this material for a group, one skeleton of an adult bull. The skeleton series is of great interest for anyone studying the evolution of types. In the case of elephant and rhino we omitted the calf; in the case of the smaller deer and antelope, we added an additional male or female or both.

THE RHINOCEROS HUNT

The animal of which we were most anxious to secure good specimens was the great Indian one-horned rhinoceros, now extremely rare in British territory, and decreasing rapidly in Nepal. In the Morang District of the Nepal Tarai this rhinoceros was plentiful not many years ago, but now not a single specimen is, I believe, to be found within two hundred miles. As regards British territory, only a few still survive in Assam.

That enlightened ruler, my friend His Highness Maharajah Sir Chandra Shumshere Jung of Nepal, fully appreciated the importance of the expedition. He first arranged that we should visit the tract of country where His Royal Highness the Prince of Wales and staff had recently shot tiger and rhino, but later proposed that we should enter the more inaccessible Gandak Valley, where there was a probability of our obtaining better specimens in a shorter space of time, once we got on the ground. But getting on the ground was not so easy. This interesting tract of country is cut off from the plains by ranges of broken hills, through which the Gandak River cuts a tortuous way to the plains, flanked in its course by a series of precipitous gorges. The valley is inhabited almost entirely by Tharus of a very fine type.

The only ways of entering the valley are by boat, towed up a swift-running stream, which takes two days, or on foot over the hills, where there is no road. In many places the trail resembles the dry bed of a mountain stream more than anything else. We took fifteen hours to do the first march of eleven miles. We came out by boat in five hours.

The Maharajah provided us with coolies and six elephants for transport, but although I have for the last fifteen years been accustomed to riding elephants over all sorts of country, the going was so bad that we did practically the whole march on foot, picking up on the way a very fine specimen of the Indian sloth bear, which luckily fell to a single shot from a .275 Rigby

Typical rhino country in the Gandak Valley of Nepal.—The female obtained by the Faunthorpe-Vernay Expedition was shot a short distance from the tree with broadly forked branches that is conspicuous on the right of the photograph

Rhino tracks deeply impressed in the soft soil

Mauser, the only weapon we had actually with us when we sighted the bear.

The Nepalese government keeps six or eight of its elephants in the Gandak Valley, near where we camped on the second day after entering Nepal, and some of the mahouts have the reputation of being expert rhinoceros trackers. We first started beating for rhino with elephants and drove out a female rhino with a small calf that lived in some patches of thorn and bush cover near the camp, which was on the river bank. We refused to shoot them, as the calf was very small and the cow had a very short horn, and we wished to make certain of obtaining good specimens. The trackers expressed surprise and regret. With this lady rhino, whom we met frequently and whom we called Lizzie, we became quite friendly, but I think she was glad when we left. Vernay on one occasion crawled up to her private mud bath and watched her at about four yards' range. Dyott with his movie camera sat over the mud bath for the next two afternoons, but Lizzie did not appear. She had a distinctly peevish expression when I last saw her.

The local trackers did not seem keen to show us big rhino, but a little heart-to-heart talk and the promise of good rewards to the trackers and also to the villagers induced the former to take us to a large solitary male rhino, that was located in a valley in the Sal Forest, containing heavy bush cover and several pools of water. This enormous

This rhinoceros, wounded by the first shot fired by Mr. Vernay, turned and charged him, but was dropped by his second bullet

slate-colored beast, apparently quite unconcerned at the presence of several men in the trees who were watching him, allowed us to approach on elephants to within about seventy yards, from which range both Vernay and I fired, with the result that after galloping about a hundred yards, the rhino pitched over dead. He was a big and very old male, whose horn had been splintered and worn down to about 8 inches by digging or fighting. This rhino was shot several miles from camp, and the taxidermist and his satellites had to spend the night by the carcass.

The trackers were bitterly reproached because we wanted horns of at least 12 inches, and it was decided that it would be more sportsman-like and also more effective to stalk the remaining specimens on foot rather than to shoot at them from somewhat unsteady elephants.

The next day, after a fruitless expedition under the guidance of the trackers, we were informed by the villagers on our return to camp that a rhino had been seen drinking in a pool on the other side of the river. The energetic Vernay immediately crossed in a boat. I sat down and ordered tea.

Shortly after arrived the Nepalese Munshi (the District Officer's assistant), who had gone out with the local Nepalese Lieutenant to shoot birds with my gun. He brought us the news that there was a big rhino wallowing in a pool not far from the river, about a mile down stream. The Munshi was breathing heavily from excitement and exertion. His account of how they came to see the rhinoceros was amusing. He said he saw what he took to be a black water bird in the pool and said to the Lieutenant, "Give me the gun and I will shoot that bird." To which the Lieutenant replied, "Brother, if there is any bird shooting to be done, I will do it myself." They then approached the supposed bird under cover of the heavy jungle on the bank above the pool, only to find that it was the horn and ears of a rhino which lay soaking in the water.

I jumped into a boat and hustled down stream. It was rapidly becoming dark, and after a hurried scramble for about half a mile over most uncomfortable pebbles, I saw the rhino still in the water and managed to get up near him just as he was leaving the pool. This proved to be a fine male with a horn measuring 12½ inches. He had evidently been fighting and had festering incised wounds on flank and in stomach.

On returning to camp I found that Vernay had accounted for the other rhino, also a very fine male, with a horn more than 12 inches in length. This animal after being wounded had tried to charge him but had been dropped in the grass on the river bank by another bullet from his .465 Holland. I was using a .400 Jeffery rifle.

The great Indian one-horned rhinoceros is, of course, the biggest rhinoceros in the world. His horn is smaller than are those of the African rhinoceroses, either the black or the white, but in height and bulk he far exceeds the African species. The males we shot measured well over seventeen hands at the withers. The one-horned rhino is a curious animal to look at. With its shields and warty protuberances it has a kind of prehistoric appearance.

It seems to be extraordinarily regular in its habits. In the evening or late in the afternoon the rhinos of the region where we hunted emerge from the heavy jungle and wallow in the numerous pools and backwaters near the

Gandak River. They spend the night in feeding and in the early morning are to be found at the edge of the heavy covers, into which they retire during the heat of the day.

We had now obtained our male rhinos, and the unfortunate taxidermist had his work cut out. We had brought down from Lucknow a good Indian skinner, named Pancham, a servant of my old friend, the Ranee of Khairigarh, but we were able to find only a very few Chamars (low-caste Hindus who skin dead cattle) in the valley to do the rough work. The villagers are almost entirely Tharus.

We still had to obtain a good specimen of a female rhinoceros, but it was necessary to wait a day or two in order to enable the taxidermist to deal with the skins of the males.

Stimulated by the rewards which we had paid for the rhinos, an intelligent headman of one of the villages, assisted by the Munshi, who, by the way, spoke a weird mixture of Nepalese, English, and Hindustani, had volunteered to locate some tigers.

THE TIGER HUNT

We went out after a tigress next day and beat for her in a patch of tree and bush jungle, along the edge of the Gandak River. I posted Vernay on the point and put Dyott, with his movie machine, in the broad nullah that divided this strip of cover from the heavy forest. I myself took up a position on the edge of this nullah, to one side of the patch. The tigress, curiously enough, was not in the patch at all but lying in a little thorn bush outside it, and Dyott, when he got off my elephant with his movie camera to go and stand in the nullah, must have passed within two or three yards of her. She rose behind me when the beat was nearly over, dashed across the nullah, and was knocked over by a lucky shot at about one hundred and fifty yards, but recovered herself and went on. Dyott was in time to secure a picture of her galloping up the bank. We put an end to her in the heavy forest not far from the bank. She had been practically crippled by the first bullet, which had hit her in the hind quarters. She was a beautiful heavy-coated animal measuring nine feet, and will be immortalized in the American Museum.

Another day we beat for a tigress farther north, also in a strip of heavy bush, thorn, and tree jungle, which narrowed down to a point to the south and was there separated by a broad nullah from the covers in which our friend Lizzie habitually lived. This tigress had come from the north and the trackers said it was impossible to beat her southward. On the other hand, there was no hope of obtaining a picture of her except by forcing her out to the south, for to the north the jungle broadened out continually and was impossibly thick with heavy thorn undergrowth. About fifty Tharus were enlisted for the purpose of beating and placed in batches between the six elephants with instructions to make a good deal of noise, while the Nepalese Lieutenant, armed with my gun, maintained an intermittent fire of shot cartridges. The tigress was forced out at the southern end of the jungle and galloped across the broad nullah, giving Dyott an opportunity of which he took full advantage, obtaining a beautiful motion picture of her dashing across the open, including the splashes of dust kicked up by bullets ineffectually fired at her. This tigress was now in the upper section of Lizzie's home, which we knew well.

RINGING THE TIGER

To ring the tiger (*Tigris tigris*) numerous elephants are employed in an encircling movement, one group going in a wide arc silently and in single file to the left and the other group in like manner to the right until the leaders of each of the two lines meet and the ring is complete. Then the elephants face inward, their riders begin to make a din, and the host of hunters converges upon the beleagured animal. The circle becomes smaller and smaller. The tiger has secreted itself in the densest patch of jungle. The fateful moment has come. Two large tuskers are sent in to rout out the concealed beast. As they move cautiously toward the center of the circle, suddenly the tiger with a great whoof makes a bound for freedom. While the agitated elephants that form the circle hesitate whether to stand the charge or turn in flight, one of the four mounted gunners takes quick aim and fires, more often than not stopping the tiger in its tracks

THE PURPOSE ACHIEVED

After a tiger has been shot the rite known as *puja* is performed and every one gathers round to view the animal

BRINGING IN THE TIGER

Even in death the tiger is dreaded by many of the elephants that are used in hunting it and more than one elephant rebelled at having the dead enemy placed upon its back. The elephant in the picture stoically accepted the burden.

The Indian elephant is an exceptionally intelligent animal and invaluable when progress is to be made through the jungle. Even when full-grown trees stand in his way they are no obstacle to his advance, for he has been taught to bring his great bulk to bear against them and uproot them. Steep banks he climbs and descends with caution, testing the ground before taking action. Though his weight may equal that of thirty-five or forty men, he moves through swampy ground with comparative ease because of the fact that his foot contracts as soon as pressure is relaxed, enabling him to lift it out of a hole in the mire without suction resulting

AN EXCEPTIONALLY FINE TIGER

The power of this animal is still apparent even though it has been deposed from its rule in the jungle and has become a museum specimen.

In the tiger group that is to find place in the Asiatic hall of the American Museum, specimens obtained by the expedition will have their reincarnation. Two cubs are still required to complete the group as planned, but the tiger and tigress that are to be the center of interest are available, thanks to the marksmanship of the members of the expedition. The animals will probably be shown drinking at a stream in a jungle thicket, with the tall grass densely massed so as to form a background

Dyott was then posted with his movie camera on a fallen tree in the center of an open space to the south, while Vernay and I on elephants took one corner each. The tigress, came out first of all, in front of Dyott, but withdrew in horror when he started turning the handle. He secured, however, a brief picture.

She then tried each corner in turn and found both stopped; the final shock to her nerves came when, upon showing herself, she was immediately charged with violence by my elephant. With morale absolutely shattered she then made a bee line to the Gandak River and swam across this swift and broad stream. We did not grieve over her escape. We did not want her as a specimen, and she had given us a film probably unique in the history of cinematography.

RESUMPTION OF THE RHINOCEROS HUNT

Having now given the skinners two or three days of comparative rest—for a tiger is a mere trifle to cope with in the taxidermy line—we got two female rhinos marked down to the south of camp, about five or six miles away. The first one retreated into impenetrable thorn scrub, but after wading through a swamp, we found the second standing in a dense clump of low trees. She had a half-grown calf with her, which was wandering about making most extraordinary noises, resembling the squawking of some large bird. We could see the mother dimly through the saplings, and Vernay stalked her on foot and shot her through the neck, at a range of about twenty yards, killing her with one bullet. The neck shot is the most deadly for rhino, aim being taken between the deep neck creases, which are such a marked feature of this curious animal, about two-thirds of the way up the neck. For this shot a soft-nosed bullet is best. The rhinoceros proved to be a fine specimen, but her horn was much worn down, measuring only about 8 inches. The taxidermist outfit spent another night out with this specimen, as in the darkness they could not return through the swamps. The Tharus built shelters of branches for them.

It was now March 14 and getting fairly warm and the skins were giving us some anxiety, as portions of the epidermis had begun to slip on one of them, but with a liberal application of a mixture of salt and alum this deterioration was arrested and, I believe, they arrived in New York in practically perfect condition.

We came out of Nepal by boat through most picturesque scenery. The river is frequently flanked by precipices and in places runs very swiftly through the gorges. Where the river bed widens, there are banks covered with crocodiles of both species, and some good films were obtained on the way down.

THE ELEPHANT HUNT

Our next trek was a long and weary one to the Billigirirangan Hills, which lie partly in Mysore territory and partly in the Coimbatore District of the Madras Presidency. This is the country described by Sanderson in the well-known book[1] in which he tells of his life among wild animals while in charge of the government kheddah operations.

Our ground was more than seventy miles from the railway. It is a charming tract of country averaging about 4500 feet above sea level, with the higher hills running up to 6000 feet.

We were dependent here on the help of the coffee planters, especially Cap-

[1] *Thirteen Years Among the Wild Beasts of India.*

tain Fremlin and Mr. Ralph Morris, who made all arrangements and provided us with skilled Sholaga trackers. We went up into the hills some seven miles from Morris' coffee estate, to a spot where he had built grass huts in a shola close to one of the many routes used by the herds of wild elephants. But the first tusker elephant was bagged before we went there. Two elephants had been for some time haunting Fremlin's coffee estate and the neighborhood. One was a muckna, or tuskless elephant, and the other a large tusker with one tusk only. It was decided to shoot the latter for the skeleton series in the American Museum, and he fell to Vernay's rifle on the day of our arrival. The Sholagas were pleased, for this elephant used to come and ravage their banana plantations. The lament, "Yes, we have no bananas" in Canarese (a most unmelodious language) was often heard in the land.

We regretted afterward that we had not shot the muckna instead for the skeleton, as he was a magnificent elephant,—I think the finest I have ever seen, either in the wild or in captivity. An elephant has as many points as a horse, and this huge muckna was not only perfectly shaped, but had a smooth and effortless action, reminding one of a really good race horse. It is extraordinary how noiselessly a huge beast like this can move through heavy forest and how invisible he is when standing motionless. When in movement he resembles a shadow and when at rest might well be mistaken for one of the big gray rocks which are abundant on the hillsides.

Warned by our difficulties with the rhino skins, we were taking no chances with the elephant hides. In addition to Jonas, the American taxidermist, we had Pancham, the Ranee of Khairigarh's skinner, four expert Indian skinners provided by Van Ingen, the taxidermist of Mysore, and twenty Madigas, low-caste men similar to the Chamars of Upper India, to do the rough work. We also had ropes and pulleys to enable us to turn the elephant's body over when necessary.

An elephant is skinned in three pieces; first the head and neck are stripped and then the body skin is taken off in two pieces by skinning down the backbone and along the center of the stomach. There still remains a good deal of work as the skin is of great thickness and has to be considerably pared down.

When on the way to the grass-hut camp at Hool Patchi Hulla we were lucky enough to fall in with a large herd of wild elephants, which contained no really big tusker (for these are generally found living solitary or semi-solitary lives) and obtained some wonderfully fine cinematograph pictures, including one of a tusker that came so close to the camera that a rifle had to be fired into the air to turn him off. This herd eventually left the shola in which they were temporarily staying and made off at a rapid pace down one of the beaten tracks which the elephants have made and regularly use in this neighborhood. These elephant tracks are, in fact, the only paths of any kind available in these jungles.

Our big tusker specimen was a stranger that arrived one day from some distance and was reported by one of the Sholagas as having taken up a position under a large and shady tree in a valley two or three miles from our camp. Making a very early start the next morning, we found him within a few hundred yards of this spot. Rain had fallen and the forest was open enough to

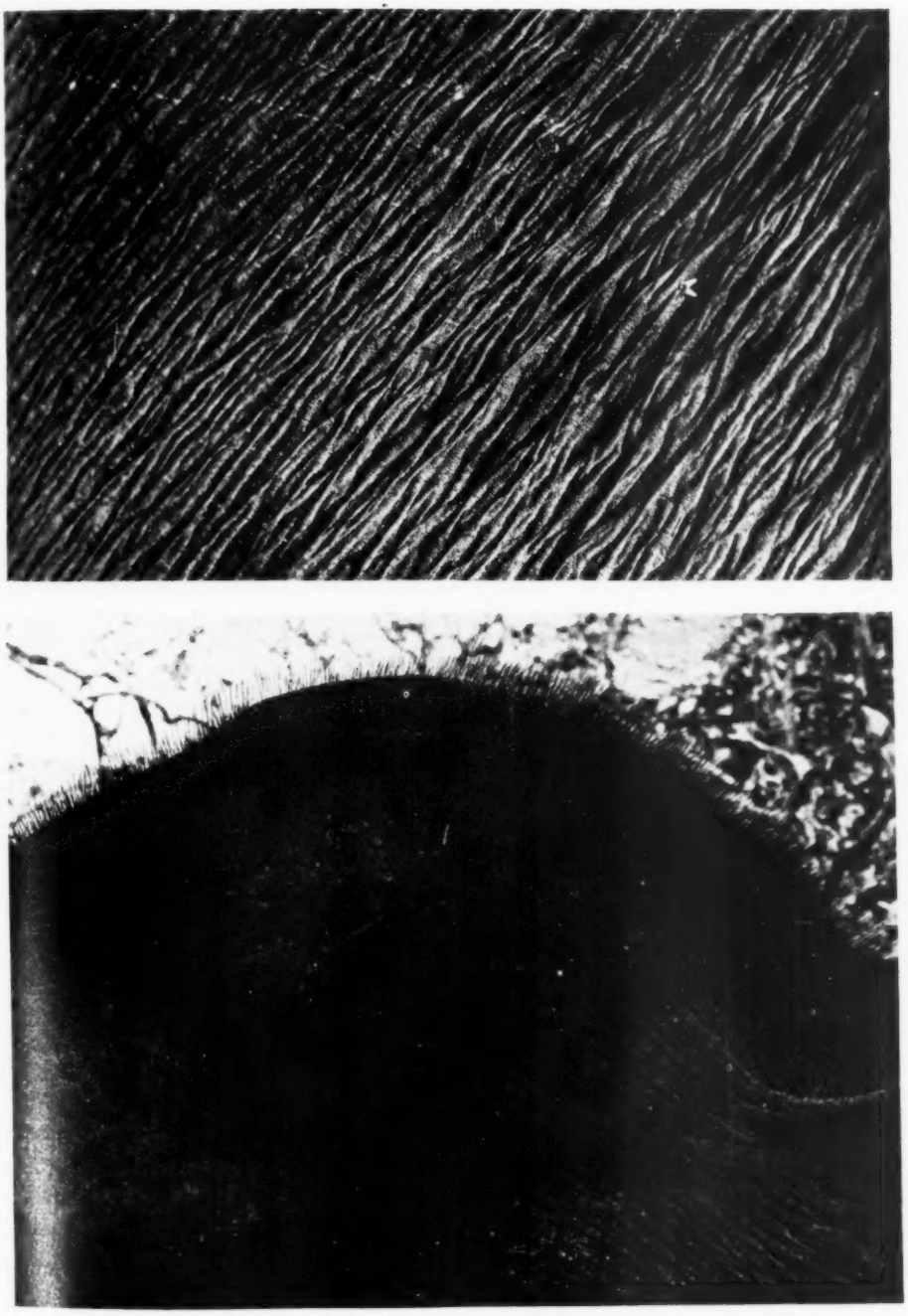
This tusker (*Elephas maximus*) was shot at a distance of not more than forty yards. He sank into a sitting posture and even in death, which was practically instantaneous, looked singularly lifelike

enable us to see from some distance this magnificent animal loafing slowly along on the hillside, plucking and eating a branch at intervals. The stalk was an easy one on the damp ground and we got up to within forty yards without any difficulty. We were slightly to his left rear. We had arranged that Vernay should take the brain shot. I supplemented this by one behind the shoulder, but Vernay's .465 bullet had reached its mark. This magnificent tusker slowly extended his forelegs and then slowly sat down, stone dead. He was supported in a sitting position by a stout tree and as he sat there dead, looked singularly lifelike.

I have had so much to do with tame elephants that I never wanted to shoot one, and we both regretted having to destroy this splendid animal. We took comfort, however, from the thought that he will attain something near immortality when set up under the Akeley process of taxidermy in the American Museum, where he will be a worthy counterpart to the fine African tusker in the group prepared by Mr. Akeley. It was with even more regret that Vernay later shot a very fine female elephant. This completed our elephant group, namely, one tusker and one female, and one tusker for the skeleton.

THE BISON HUNT

Owing to the grass having been very little burned, bison tracking was difficult, but on March 30, a big solitary bull was located in the lower



The elephant, when viewed at close range, looms so large that one is apt to have one's attention absorbed by his bulk and proportions to the neglect of the details of his anatomy. Yet a closer examination reveals many points of interest. In the upper picture is shown a section of the hide, rugose and tough in character. The head of the animal is not bald but, as indicated in the lower picture, is covered with a rather plentiful growth of upstanding hair

country. To approach him involved not only climbing an awful mountain, which almost invariably had to be negotiated before one could get anywhere, but also walking along the ridge with a similar descent at the other end. I shall never forget that mountain. Walking up and down hill never was one of my favorite recreations; Vernay seems to enjoy doing so.

The Sholaga trackers took some time picking up the bull's tracks and by the time they did so the sun was well up and we had to hurry, as the bull, they said, was making for some heavy cover where he would probably lie for the day. After crossing a couple of low ridges we came up with him on a steep hillside. The stalk down hill was a simple one and he was disposed of without difficulty, a fine old black solitary bull with horns measuring more than 20 inches in girth at the base, but considerably worn and splintered at the tips.

SLOTH BEAR, TIGER, AND LEOPARD

We still had to get another bison bull, a cow, and a calf. These Vernay and Morris undertook to shoot and, as it was now April, I was anxious to get up north in order to secure the required specimens of sloth bear, tiger, and leopard. There was also a better prospect of getting good cinematograph films, especially of deer, up north.

Dyott and I left the Billigirirangan Hills and made the long and wearisome journey up to Oudh. Here we were joined by Turner, the Forest Officer, and by Kunwar Dillipat Shah of Khairigarh. Turner undertook to arrange cinematograph pictures of deer in a small block of outlying forest, which had been carefully kept undisturbed. Dyott and he put in three or four days of strenuous work and obtained some really good pictures of herds of chital, antelope, and nilgai.

In the meantime Dillipat and I were concentrating on getting a bear group, and at first were singularly unsuccessful, not because there were no bears about, but because we seemed to be unable to hit them. Very few elephants are steady to bear, and those we had were not. Dillipat is, as a matter of fact, an exceptionally good shot at a running animal, but both he and I missed several bears before I eventually hit a large male in good coat, worthy of being included in the bear group in the Museum. This bear, when hit, stood up and bit through a sapling before he fell dead. The female bear we had previously obtained in Nepal when after rhinoceros. Turner shot another very big bear, which, although it had a bad coat, was desired for the skeleton series.

The sloth bear is a very bad-tempered animal and will frequently attack human beings absolutely unprovoked, as will also the wild boar at times. The jungle people are much more afraid of the sloth bear than they are of the tiger and leopard.

One day we were beating ratoa grass patches (ratoa is a very dense grass somewhat resembling sugar cane) for bear when the elephants gave sign of the presence of tiger and I was fortunately able to shoot a fine male in good coat, measuring 9 feet 8 inches, which was immediately earmarked for the Museum tiger group. I also shot a very fine leopard close to camp one evening.

Quite by chance I found one morning a place which provided us with very beautiful pictures of deer and pig coming down to drink at a pretty little pond just inside the forest. I saw a herd of chital there and we found a

tree in which Dyott could sit with his movie camera and command the pond. He spent about three days in this tree, and the results are, I think, the most beautiful cinematograph pictures I have ever seen.

On April 19 we were joined by Vernay, who brought with him—as I had a shooting pass for tigers and certain other game in Nepal across the border—Fremlin and Morris, the coffee planters who had been so good to us in Mysore. They had shot tigers before but never had seen the method of beating them out with elephants, which is practically the only method employed in my part of the country. They secured three tigers.

Vernay had, as anticipated, completed the bison group in addition to shooting a big leopard, and had safely delivered the skins and skeletons of bison and elephants to Van Ingen of Mysore, who undertook to pack them for shipment to New York.

No one who has not seen the enormous size and weight of a big elephant's bones and hide can appreciate the labor involved in transporting them across country. We were about 5000 feet up in the hills and the whole collection had to be carried six miles by coolies and twenty miles by bullock carts. For the balance of the distance to the railway, motor lorries were fortunately obtained. It required a good deal of organization.

Curiously enough, although leopards are numerous in that neighborhood, we failed to obtain a female leopard and two cubs, which were wanted for the group, although we spent some time trying to get them. Conditions had been unusually wet at the time when the grass outside the fire-protected forest is usually burnt, and the leopard, extraordinarily skillful in concealing itself and evading the line when being beaten with elephants, had us at a disadvantage.

Dyott had an interesting experience one day. One of my men who had been sent to a place eight miles away came in with the local forest guard and reported that early that morning they had seen a large tiger asleep by a pool of water near a patch of ratoa grass just inside the forest. It was a terribly hot day but it was decided that, if the men thought it worth their while to walk eight miles, it was up to us to go and investigate matters.

Four elephants—all that were available—were therefore sent off at once and Dyott and I followed in a light Overland car, which is a first-class conveyance over unmetalled roads and forest tracks.

The tiger, which, judging by the smell, had a kill in an extremely high condition, was duly aroused, ran out of the grass, and stood in the forest with his head and shoulders concealed by a

A chital faun.—This beautiful animal (*Axis axis*) retains the white markings in the adult stage and is popularly known as the spotted deer. The chital is inclined to be gregarious in habit and this little faun showed no timidity when handled by its captors

Typical tiger country on the Nepal border

One day a tiger, though wounded, succeeded in secreting itself in the high ratoa grass. Four elephants moving abreast were directed toward the area where the tiger was supposed to be. Colonel Faunthorpe, gun in readiness, was mounted on one of them. Suddenly the tiger jumped from its place of concealment right up on the elephant's head, but its claws had scarcely touched the thick hide when it dropped back dead, shot by the Colonel in a vital spot. The picture shows the elephants approaching the place where the tiger lies crouched, invisible in the high grass

tree. I was, therefore, compelled to shoot him through the center of the body instead of getting a deadly and crippling shot at the center of the shoulder, which is the most effective shot of all, as it not only brings the animal down with a broken shoulder but also kills him.

The wounded tiger dashed back into the grass, where we hunted for him for some time without his showing a sign. The men, who had had a long trek in great heat, were getting rather disheartened, especially when one of them found a bullet mark in a tree where the tiger had been standing when I fired.

Examination proved, however, that this was merely the base of the nickel-covered soft-nosed .400 bullet, which had clearly, therefore, gone through the tiger. The men, of course, did not believe this, but we went on beating up and down this extremely dense grass. I was, personally, confident that the tiger was either lying very close in it or was actually dead, and the grass was so thick and matted that had he been dead, he might easily have escaped notice. We were beating the grass for the third time, when there was a sudden snarl and a rush at the edge of the grass and the tiger jumped on the flank elephant and clawed her severely across the top of the trunk. The beast was now located. There happened to be a forked tree close by, into which Dyott climbed and lashed his movie camera.

The four elephants were formed in line and, with extreme reluctance, advanced on the place where the tiger had settled down. Each mahout was trying to keep a little bit behind the others. They were eventually persuaded to advance with a little more speed and the tiger, with another snarl, jumped right up on to my elephant's head, but a snap-shot, as he landed, took him between the eyes, a very lucky fluke which saved old "Lachma" from a severe mauling. She received only one almost invisible puncture from a claw. Throughout she stood like a rock, otherwise I should no doubt have missed the tiger.

Not always is the tiger ringed or driven out of the jungle by the heavy approach of elephants. Another method of hunting is to place a platform, known as a *machan*, high up in the fork of a tree and from that point of vantage await the return of a tiger to his kill

While this was going on Dyott was turning the handle of the movie camera. We hoped for a wonderful film. It is one of the greatest disappointments of my life that, owing to the height of the grass, the tiger does not show in the film when on the elephant's head, though one can clearly see that something has charged the elephant and has been shot.

A common Indian squirrel (*Funambulus*)

CONCLUSION OF THE SEASON

The expedition concluded its work with a visit to Burma, where the Governor, my old friend Sir Harcourt Butler, gave us every possible assistance.

We wanted groups of tsine, an animal akin to the Indian bison, and of the thamin, or brow-antlered deer, and succeeded in getting both in the Magwe District. We also obtained a group of the barking deer and added several interesting specimens to our collection of the smaller mammals, birds, and reptiles. We did not succeed in finding a hamadryad, but secured several specimens of that beautiful but dangerous snake, the Russell's viper.

The bamboo rat (*Rhizomys*) of Burma lives in holes in the ground under bamboo clumps

It took a lot of work on foot to get the tsine. In fact, I think this animal is the most difficult to stalk that I have ever met. He is very active and when grazing and wandering about, appears to move much faster than the bison, and when he has settled down for the day, is so wary that it is almost impossible to approach him. Hunting the tsine was really hard work, and it was infernally hot.

Our work for the season was now complete. The collection totals about 450 specimens, of which 129 are mammals. We have also some 26,000 feet of cinematograph film, including many animal pictures which I believe to be absolutely unique. Nor was the cinematograph work confined to shikar subjects. We took a very large number of pictures illustrating native life, which, when shown in America, will lead to a better comprehension of the true condition of India and Burma. The movie camera used was an "Akeley," which, because of its simple and rapid elevating and traversing mechanism, is by far the best for this kind of work.

We obtained groups of all the larger animals of the plains of India, with the exception of the Indian buffalo and the Indian lion, and we hope to secure these this year.

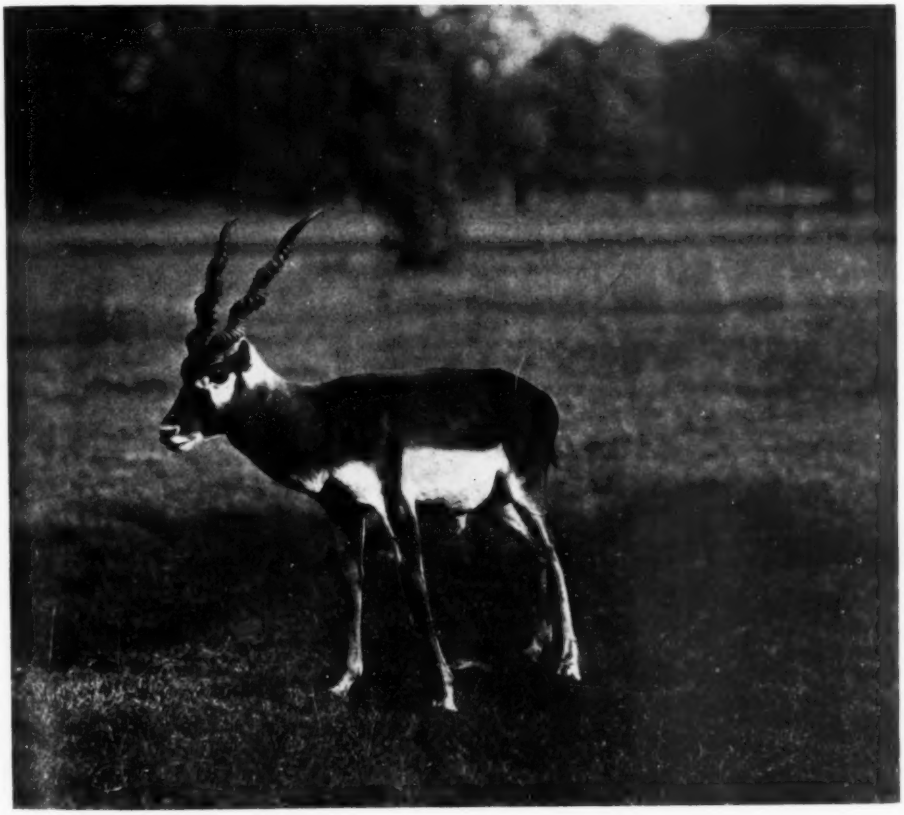
The expedition is not over. Vernay is now going from Moulmein on the coast of Burma across the Ta-Ok

Plateau, which lies partly in Burmese territory and partly in Siam, to the Meping River and thence to Bangkok, and hopes to obtain some valuable specimens. The Ta-Ok Plateau is very little known and has never been properly explored from a natural history point of view. It is believed to be particularly rich in birds, and an ornithologist, obtained from the British Museum, is accompanying the expedition. I, myself, shall probably visit India to complete the Indian collection this year and it is possible that both Vernay and I may also visit French Indo China.

As for the collection made in India, Burma, and Nepal last year, complete groups were obtained in nearly all cases and the collection as it stands is probably unique for this reason.

The elephant, bison, and rhino specimens are exceptionally fine ones and both the tiger and tigress are unusually good specimens, with good coats. Among the deer, we have several specimens which approach the record in horn measurement; for instance, a 39½-inch swamp deer and a 38-inch spotted deer.

In addition to the mammal groups, numerous specimens of reptiles and



The blackbuck (*Antilope cervicapra*) is one of the most beautiful of the Indian antelopes. The popular name does not apply to the young males. These are tolerated by the lord of the herd until they begin to turn black, when he forces them out of the family circle

birds were collected—some of the latter in particular being of rare species. We made particular efforts to obtain the pink-headed duck but the nearest we came to this rare bird was hearing of one which had been eaten by a planter two years before. Renewed efforts are being made this season to obtain it and, if it is not extinct, I am not without hope that a specimen may yet be secured.

It only remains to add that, with the exception of three or four tigers and here and there a specimen required by Mr. Vernay for his private collection, we shot nothing which did not go to the American Museum. And we are proud to be able to say that not a single animal got away wounded.

Russell's viper (*Vipera russellii*), a beautiful but dangerous snake, of which the expedition secured several specimens

Stalking Tsine in Burma

By ARTHUR S. VERNAY

Joint Leader of the Faunthorpe-Vernay Indian Expedition of 1923

ONE of the objects of the Faunthorpe-Vernay Indian Expedition of 1923, was to obtain representative groups of the bovines of the plains of India, and also of Burma. To accomplish this purpose it was necessary for us to secure specimens of the gaur (*Bibos gaurus*)—known to sportsmen as the Indian bison,—the banting or tsine (*Bibos banteng*), and the buffalo (*Bubalus bubalis*). The mithan (*Bibos frontalis*), which in parts of Assam is domesticated and even in its wild state breeds very freely with tame cattle, we did not consider worth pursuing. The yak (*Poëphagus grunniens*) we excluded because its habitat is principally Tibet and northern Ladakh, and these regions on account of their remoteness did not figure in our plans. We were fortunate in being able to obtain in Mysore magnificent specimens for a group of the gaur. The buffalo requires a special bandobust; this has been arranged for and will take place in the spring of 1924, when, it is hoped, the material necessary for a group may be secured. The tsine we decided to hunt for in the dry zone of Upper Burma.

I had a good deal of experience two years ago, and during the last year, in pursuing the gaur and found this animal sufficiently wide-awake to require considerable effort on the part of the hunter. The ground where we hunted, the Billigirirangan Hills, southern Mysore, which lie partly in Mysore territory and partly in the Coimbatore District of the Madras Presidency, is the country which Sanderson described in his book, *Thirteen Years Among the Wild Beasts of India*, in which he writes of his life while in charge of the keddah operations of the government. Our actual hunting ground was seventy miles from the railroad, in a country of irregular steep hills, from 4000 to 6000 feet above sea level. One can readily imagine that a wild country of this kind with obstacles in the shape of precipitous hills and heavy jungle make the tracking of bison a somewhat arduous but at the same time fascinating pursuit.

Colonel Faunthorpe and I came to the conclusion that it was pretty stiff going, and that the bison is a wily and difficult animal to stalk. However, the bison is a mere novice in comparison to the tsine. I had heard from a friend of mine who had previously hunted tsine, of the difficulty of tracking them. He had told me that he considered the tsine the best sporting animal of the bovine family, for apart from being gifted with a wonderful sense of smell, perfect eyesight, and acute hearing, it is of a most uncertain temper and, even when unwounded, is liable to charge on sight, and, when wounded, will fight to the very last. Consequently, after finishing our shoot in India, it was with great interest that we journeyed to Burma to hunt this animal.

We arrived in Rangoon in May, hoping vainly that the rains would descend so that tracking might be easier. Going up the Irrawaddy to Migyaungyi, we turned east to Taungdwingyi, where we fitted out and proceeded through the jungle to a place called Zilon. The weather still continued fair. We hunted for several days without result, and decided that we

WHERE THE TSINE IS AT HOME

To pursue the wary animal through the trackless bamboo jungle that is littered with windfalls of hollow stems, hour after hour in the heat of the day, requires patience, endurance, and no small measure of devotion to one's task

would move our camp to a place called Shweban; and here the serious tracking began. Unfortunately the rain would not come, a condition which made tracking extraordinarily difficult. The ground was dry and hard, with the result that tracks showed very indistinctly, making pursuit extremely

baffling, for the tsine, being almost always on the move, naturally goes a great deal faster than the tracker. If by chance the wind is in the wrong direction, all one hears is a loud snort as a huge animal crashes through the jungle. That is the end for the time being of one's efforts; the only thing one can do, once the tsine has been alarmed, is to rest for an hour and a half or two hours without making any noise whatsoever, and then again take up the tracks with the hope of coming up to the animal. Notwithstanding, we eventually secured one good herd bull, but what we wanted was a fine old solitary bull, which is of a chocolate color, the herd bull being of a pale brown, somewhat like the brown of the Ayrshire cow.

Generally in hunting the tsine, it is necessary to start before daybreak so as to get on the tracks made during the night. Quiet going is extremely difficult as one follows these tracks through the jungle, which is, as a rule, bamboo, and is cluttered with leaves and with windfalls of the hollow stems. One morning we started out at 4 A.M., and at about 7 o'clock came upon the tracks of what must have been an enormous solitary bull. The mere fact of seeing such large tracks is exciting in itself. One mentally compares the hoof marks with other bull tracks one has seen, and visualizes the size of the animal that made them. After stalking this bull for an hour, we came across the tracks of a smaller bull, and a few yards from the point where they had met were the evidences that a battle had been waged. The tsine, always ready

The tsine is one of the members of the bovine family that was especially desired by the Faunthorpe-Vernay Expedition and that proved more elusive and difficult of pursuit than most of the other big-game animals collected by this expedition

to fight, had come face to face with an antagonist of his own stamp, and the issue had to be decided there and then. The whole place was trampled down; small trees were crushed and broken; large trees were scarred; bits of bark, which had been ruthlessly torn from the wood, hung down like great brown ribbons; and the ground bore the imprint of a multitude of hoofs. Eventually, the signs indicated, the smaller combatant had been driven off, and the solitary bull, doubtless still snorting with anger, had gone on his way victorious. The record of happenings in the jungle can be read by any one used to hunting. In the case of tiger, elephant, rhinoceros, and bison, the various struggles, the hours of sleep, and the hours of standing still and feeding are all indicated, but this was the greatest evidence of battle I had ever seen.

We were cheered by the thought that the solitary bull must be tired after all this fighting and we took up the pursuit hopefully. We followed on and on. The sun was hot, and no glimpse of the animal rewarded our efforts. At 5 o'clock, after having made a huge detour (and one can never know exactly where one is going in this bamboo jungle maze), we came back to exactly the same spot where the old bull had fought the battle. He had started out probably satisfied that he had given his foe a thorough beating, but on mature consideration had decided to return to the place of combat and see if his adversary required any more attention. Apparently he did not; but our expressions of disgust, if repeated, would

* Native helpers enjoying a brief respite in the course of the day's tramp

shock the reader. Apart from the physical fatigue, we had no ambition to continue the pursuit because we figured the bull might repeat the performance, and that would become rather tiresome. Also we thought that eight hours of solid tracking of this particular animal entitled him to exemption from further annoyance.

We obtained besides the herd bull a fine specimen of a cow, which is to be used in the American Museum group. Still the rain did not come; as a result, during twelve days we tramped over more than 200 miles tracking tsine, and only saw the two which we shot, although we heard several others of which we did not get a glimpse.

As our next expedition into Siam will give us the opportunity of obtaining a large bull including its skeleton, we decided to go back to India and catch our boat for England. I left, having the greatest admiration for the tsine and with an ardent desire to come to close quarters with him once again. I hope when the next hunt takes place it will be raining.

The home of the tsine is throughout Burma and the Malay Peninsula, as well as in Sumatra, Siam, Borneo, and Java. The tsine is very like the gaur, but with a smaller dorsal ridge and legs that are longer in proportion to the body. The color of the cows and young bulls is a rather bright reddish brown, but it varies greatly. The old bulls are darker, but not black as is generally asserted. Both sexes have a whitish oval area on the buttocks extending to the root of the tail. The tsine, which is about 5 feet, 4 inches at the shoulder, shows a greater preference for the grass plains and the flatter bamboo jungles than does the gaur, and although an extraordinarily good climber, is not quite such an adept as the latter. If any sportsman has the ambition to test his patience, determination, and skill in tracking, I suggest that he visit the habitat of the tsine. He will then have every opportunity of testing himself out, and if he obtains a good specimen, I think it will be placed in his trophy room as the most treasured of his acquisitions. The tsine asks no quarter and gives none, and though the hunt ends successfully, one cannot but regret that such a fine animal has been killed; at the same time the trophy serves as a reminder of a great event in a sportsman's life.

This structure, typical of the architecture of Burma, brings to mind the settlements of that land just as the tsine recalls the bamboo forests and life in the open

The Disappearance of Wild Life in India

By LIEUTENANT COLONEL J. C. FAUNTHORPE

ALTHOUGH much of the wild life of India has disappeared and what has survived is in jeopardy, the Faunthorpe-Vernay Expedition has made possible the perpetuation in the form of lifelike groups of a number of animals that might otherwise to a large extent have passed out of ken. Altogether it obtained 450 specimens, of which 129 are mammals.

It was particularly fortunate that Messrs. Faunthorpe and Vernay when in the field, chose with a rare sense of discretion just the representatives of this magnificent fauna that President Henry Fairfield Osborn was most anxious to have on exhibition in the Museum's new Asiatic hall. Especially noteworthy among these are: Indian elephant (*Elephas maximus*), one-horned rhinoceros (*Rhinoceros unicornis*), gaur (*Bibos gaurus*), chital (*Axis axis*), thamin (*Rucervus eldi*), sambur (*Sambur unicolor*), the swamp deer (*Rucervus duvaucelii*), tiger (*Tigris tigris*).

Other invaluable contributions are a bull and cow tsine (*Bibos banteng*), nilgai (*Boselaphus tragocamelus*), and blackbuck (*Antilope cervicapra*). Among the series of deer we cite the barking deer (*Muntiacus muntjac*), the hog deer (*Hyelaphus porcinus*), and the pygmy musk deer (*Tragulus*). The Artiodactyla also include the Indian gazelle (*Gazella bennettii*) and fine horns of the ibex (*Capra sibirica*). Besides the tiger mentioned above, there are other carnivores, such as the leopard (*Panthera*), hyæna (*Crocuta*), sloth bear (*Melursus ursinus*), wolf (*Lupus pallipes*), jackal (*Thos aureus*), and a number of smaller forms. A few bats, rodents, and Primates bring this collection up to about forty-two species.—HERBERT LANG.

IN a previous article of this issue I stated that within a measurable space of time there will be practically no game left in India, except in preserves maintained by native chiefs and in certain of the more inaccessible tracts of Government Forest Reserves. I believe that this statement is no exaggeration. Causes of the disappearance of wild mammals, and of game and other birds are as follows:

1. The destruction of the jungle in which they live, owing to the expansion of population and the placing of larger areas under cultivation.
2. Disease.
3. The demand for skins and feathers by the fur and plumage trades respectively.
4. Destruction of game by firearms.

I shall deal with these causes *seriatim*.

THE DESTRUCTION OF JUNGLE

In many parts of India the disappearance of game was inevitable as population increased and all the arable land came under the plow. There are now large areas where cultivation is so universal that there is not even enough waste land to provide grazing for the village cattle, which in many heavily populated districts are now stall-fed. This cannot be helped nor, indeed, is it to be regretted: there is plenty of jungle left.

DISEASE

Owing to the fact that the Hindus, who form the majority of the Indian population, consider the cow to be a sacred animal, enormous numbers of feeble and worn-out cattle are kept alive. Foot-and-mouth disease is common; rinderpest occurs less frequently. When fodder and water are scarce, the village cattle are pastured in the jungles, where they would not usually penetrate, and may communicate these diseases to such wild animals as are susceptible to them. In times of famine, the government must necessarily throw open to cattle reserved forests which in normal times are closed to grazing.

In the great famine of 1897, when practically all the drinking water, except in the larger streams, dried up over large areas in the forests of the Central Provinces, as described in Kipling's *Jungle Book,* cattle and wild animals had to use the same drinking places, and the buffalo (*Bubalus bubalis*) and bison (*Bibos gaurus*) were attacked by rinderpest and much reduced in number. In most of the forests of the Central Provinces the bison have recovered, but the mortality among the wild buffalo, a rarer animal, was greater, and even now buffalo exist only in small numbers. In the Billigirirangan Hills in southern India, where the Faunthorpe-Vernay Expedition obtained specimens of bison and elephant for the American Museum, there was considerable mortality among the bison two or three years ago. Cattle infected with foot-and-mouth disease had been pastured in remoter jungles than usual.

I remember, also, local epidemics of foot-and-mouth disease among antelope and swamp deer. The mortality, however, from this disease is not very high. Only a certain proportion of the animals are attacked and it is probable that of these some recover. Disease alone will never exterminate the game of India.

THE FUR AND PLUMAGE TRADE

Few Indian animals have valuable fur, and not so many, therefore, are destroyed by the pelt hunter as in some other countries. Demand, however creates supply, and if there is a popular desire for the skin or plumage of any animal or bird, the effect soon becomes noticeable. For instance, about ten years ago the skin of the snow leopard (*Uncia uncia*) became fashionable in England as a fur, and the result of this has undoubtedly been to diminish very largely the number of snow leopards in India and across the border. This animal lives only in the higher hills of the Himalayas, most of which are beyond the British border, but native hunters from Thibet and elsewhere bring skins of the snow leopard to certain markets in British territory. Such a skin is now worth, in the local markets, about four times as much as it was fifteen years ago, and even so it is difficult to buy good skins.

The demand for the white egret's plumage (that of the *Herodias alba, intermedia,* and *garzetta*) brought about the almost complete extinction of these beautiful birds. Wandering gangs of plumage hunters used to scour India for them. Their *modus operandi* was to catch one with birdlime and peg it down on the ground. The other egrets in the colony would then fly around the tethered one and were caught in nets without difficulty and killed. As the plumage develops only in the breeding season, when the young are dependent on the parent, the extermination of the birds was rapid. Legislation was introduced eventually, prohibiting the export of egret feathers, and I am glad to say that in a few places the plumage-bearing egrets are now on the increase. I find, however, that egret plumes, like whiskey, are obtainable in New York.

DESTRUCTION OF GAME BY FIREARMS

The disappearance of game is frequently ascribed to over-shooting by sportsmen, but moderate shooting by sportsmen will never exterminate game, because the sportsman does not kill females or immature males and does not take game in the closed season. When game is exterminated in places where

suitable cover for it remains, it is, as far as my experience goes, invariably due to the ravages of the local pot-hunter. The number of guns in the villages has of late years greatly increased; the use of modern rifles by Indians of the upper and middle classes has become common; and the rules about the closed season, etc., have practically become a dead letter. In the Lucknow Division, the District Officer of Sitapur District told me recently that partridges, both black and gray, formerly abundant, had been almost exterminated. In the Hardoi District of the Lucknow Division, the Indian antelope (*Antilope cervicapra*), formerly abundant, is now very rare. I made careful inquiries last year in several districts where the great Indian bustard (*Choriotis edwardsi*) used to be found, but was unable to come upon anyone who had seen any of these birds recently. The pink-headed duck (*Rhodonessa caryophyllacea*), which is a nonmigratory bird with a very local habitat, is either extinct or very nearly so, and this fate will no doubt overtake other nonmigratory ducks and other edible birds.

In the Nepal Tarai, the low-lying tract of country between the Himalayas and the British border, it is extremely unusual to see any deer at all. These have all been shot out by the Tharu villagers, who, armed with guns, have been accustomed to sit in trees over every game path and drinking place. The Carnivora now live practically entirely on cattle. The swamp deer (*Rucervus duvaucelii*) in some of the best grounds in the Kheri District of the Lucknow Division have similarly suffered from the proximity of Tharu villages, and in the Kheri District it is now only in the preserves of the Rani of Khairigarh that this rare and beautiful animal is found in considerable numbers.

In the Magwe District in the "dry zone" of Burma, where the Faunthorpe-Vernay Expedition went in search of the brow-antlered deer, or thamin (*Rucervus eldi*), we found these beautiful animals very scarce indeed, and in many jungles in which they undoubtedly occurred in large numbers a few years ago, not a single specimen is now to be seen.

In several districts in the United Provinces, the Indian gazelle, or chinkara (*Gazella bennettii*), has been largely reduced in numbers by netting. This animal lives in ravines. A net is placed across a steep ravine and the gazelles are driven into it. A similar method is employed for antelope, which are first forced or maneuvered into a field of millet, or other high crop, and then driven into a net erected around one corner of the field. The destruction thus wrought is, however, trifling compared to the damage done by firearms. Netting will not exterminate game.

The great Indian one-horned rhinoceros (*Rhinoceros unicornis*), formerly abundant in the swampy country of the Tarai all the way from north Oudh to Assam, now survives in British territory only in a small portion of the Assam province. Its survival in certain tracts of Nepal is due solely to the fact that in that country it is considered royal game and is rigorously preserved. And even in Nepal it is, I believe, rapidly diminishing in numbers. In Burma, where the *Dicerorhinus sumatrensis* and *Rhinoceros sondaicus* both occur, there is demand for their flesh and, on the part of the Chinese, particularly for their horns, which Mr. Douglas Burden tells me are also in demand in French Indo

China. As a result these mammals have been slaughtered to such an extent that last year the Burmese government prohibited the shooting of rhinoceros altogether. Whether this prohibition will be effective, in view of the difficulty of supervision over the tracts where these interesting animals still survive, remains to be seen. A native forest guard requires a lot of supervision, and a gift of rupees or meat by the poacher naturally appeals to him.

The Governor of Burma, Sir Harcourt Butler, has, however, given special permission to Mr. Arthur S. Vernay, who is now collecting for the American Museum in Burma and Siam, to take specimens for that institution. If Mr. Vernay can get these rhino specimens, he will be lucky.

CONCLUSION

From the above remarks it will be seen that in places where suitable jungle for animals still remains—and there are many such localities—the only cause which can lead to the extermination of game is the more or less unrestricted use of firearms by the natives. As things stand now, there is very little game in British India (I am not referring to the native states) except in the Government Forest Reserves. These are likely to be provincialized, and who can tell what will then be their fate? Especially as (I quote from a recent report to a Royal Commission) "it is not unlikely that the lawyer will soon dominate the political world in India." Government Service in India is becoming increasingly unpopular—with the causes for this it is unnecessary to deal in an article of this kind, but the disappearance of wild life in India is one of the reasons why.

The chital (*Axis axis*), one of India's most characteristic animals

Fossil Animals of India

THE IMPORTANCE OF THE COLLECTIONS MADE BY THE SIWALIK HILLS INDIAN EXPEDITION UNDER BARNUM BROWN

By W. D. MATTHEW
Curator of Vertebrate Palæontology, American Museum

INDIA today vies with central Africa as the home of many magnificent types of large mammals. Yet its great game animals, hardly rivaled elsewhere in the world, are but a pitiful remnant in comparison with the fauna that inhabited the country toward the close of the Age of Mammals. These extinct animals are principally known from the fossils preserved in the Siwalik Hills, or Sub-Himalayan ranges, south of the main range of the Himalaya Mountains, and hence are generally called the Siwalik Fauna. This fauna has been well known for many years and is notable for the great number and variety of large animals it contains. Many of these are among the classic examples of geologic textbooks, and the giant tortoise *Colossochelys*, the extinct elephants, stegodons, and mastodons, the *Sivatherium* and other extinct giraffes, the hippopotami and hornless rhinoceroses, were familiar in the last generation to freshmen taking Geology 1, and even perhaps to that remarkable schoolboy that Macaulay used to write about.

Skull of the extinct Siwalik hippopotamus. It differs from the modern hippo in having three, instead of two, upper incisors on each side. *After Falconer and Cautley*

The fossils of the Siwalik Hills were discovered about ninety years ago. They were made famous by the great collections brought together and described by Sir Proby Cautley, an English army officer, and Dr. Hugh Falconer, a very able and active Scotch palæontologist. The chief discoveries were in the foothills along the southern flank of the great Himalayan range, from the Sutlej to the Ganges. The Nerbudda River in central India, the Irrawaddy River in Burma, and Perim Island in the Gulf of Cambay, were also sites of some of the early discoveries, and in more recent years great finds have been made in the Salt Range of northern India and districts in Baluchistan, as well as in the classic Siwalik Hills.

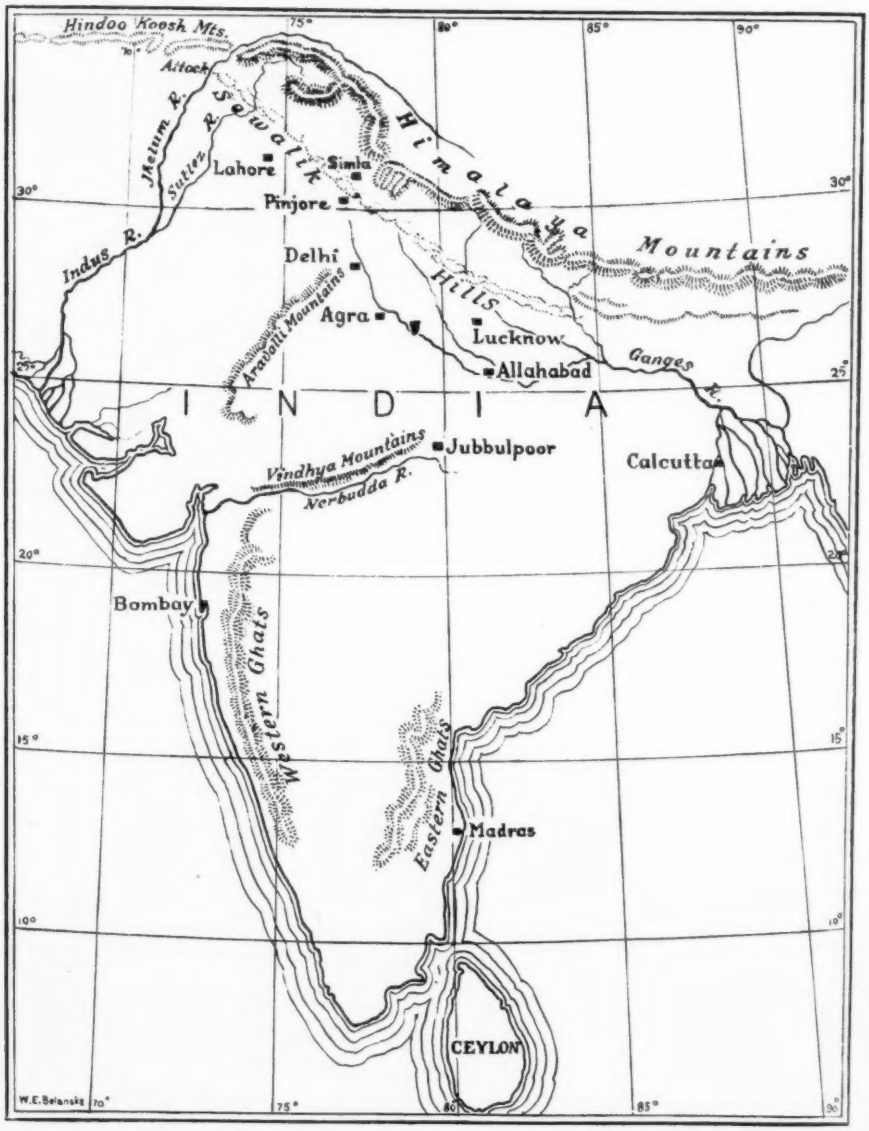
The specimens are mostly in the British Museum, London, and in the collections of the Indian Geological Survey in Calcutta. A few were sent to the Edinburgh, Oxford, and Dublin museums. They were described and illustrated in a magnificent series of

The *Sivatherium* as restored in H. N. Hutchinson's *Extinct Monsters* from remains found in the Siwalik beds of India. The animal was related to the giraffes, although very different in appearance and as large as a rhinoceros

folio plates issued under the joint auspices of the British government and the East India Company, and later in a series of memoirs of the Indian Survey.

Until last autumn there were no Indian fossils in the American Museum except for a small collection received in an exchange, and a number of casts, mostly of very poor quality. So far as the writer is aware, there are none of any importance in any other museum in this country or on the continent of Europe. Professor Osborn had hoped for many years to make a collecting campaign in India, but the opportunity to carry out these plans came only two years ago through the generous support of Mrs. Henry Clay Frick, who has met the entire costs of the Siwalik Hills Indian expedition.

The Indian government authorities responded most courteously to inquiries made by the Museum as to collecting in that country, giving us a cordial welcome and valuable assistance in many ways. The question may well be asked, why should we wish to do over again a task that has been done so well by Anglo-Indian scientists many years ago. Well, there were several reasons. First, that the field was probably far from being exhausted and a new search would almost certainly disclose many new or little-known animals, in addition to those already well known. Second, that it was important for the researches of this Museum to have a large series of these extinct animals of India for comparison with those of other parts of the world, especially of China and Mongolia. Third, that the methods and technique of collecting specimens and the exact recording of the geological horizon of each specimen have been very greatly improved in recent years by American collectors, and we believed that we could secure more perfect specimens

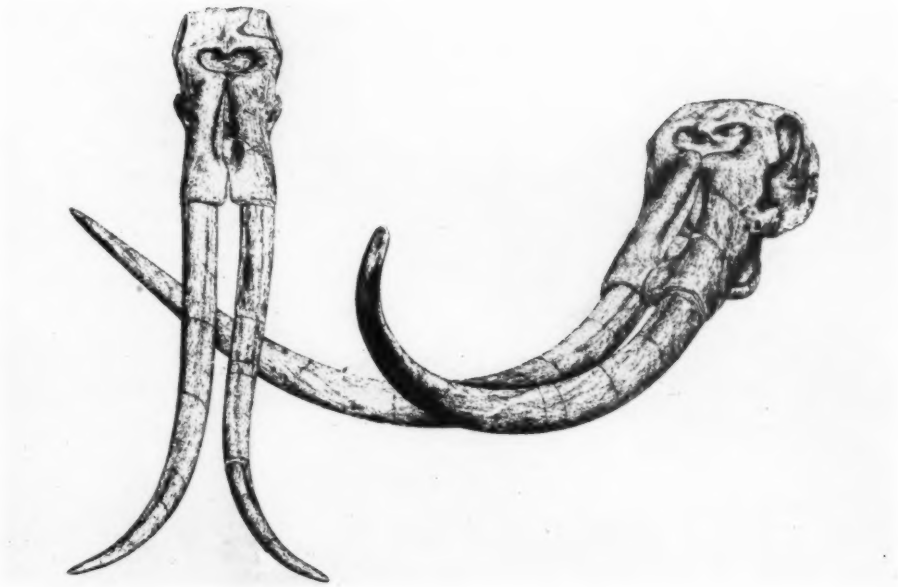


Sketch map of India, showing the location of the Siwalik Hills. Re-drawn from a map published by Falconer

and a more certain knowledge of the succession of faunas that inhabited the region than was possible under the old methods. Fourth, that we might secure additional evidence bearing on the evolution of man.

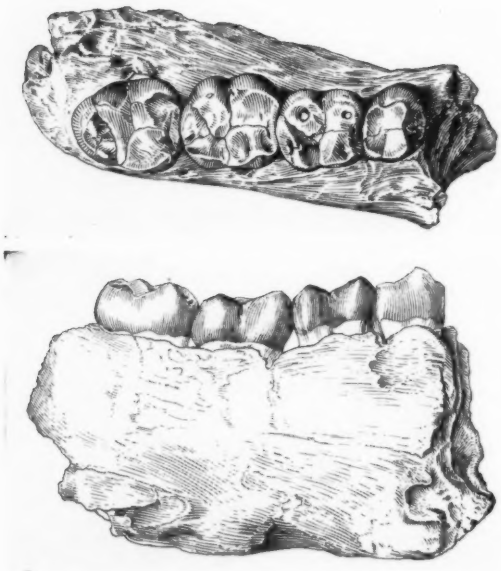
The field campaign was undertaken by Mr. Barnum Brown, whose practical experience and skill in overcoming the difficulties of a region somewhat different in type from our usual collecting grounds gave the best promise of success.

The Siwalik terrane is one of enormous thickness (about 14,000 feet). It was made up of the outwash from the main ranges of the Himalayas at a time when they were rapidly rising, although



Skull of *Stegodon ganesa*, the finest of the extinct Siwalik proboscideans. The tusks are nine feet long. The original skull is in the British Museum; casts of it may be found in many of the older scientific museums of Europe and America. *After Falconer and Cantley*

Skull of a Siwalik mastodon in the Brown collection, partly prepared.—It will be described and figured in Professor Osborn's forthcoming memoir on the extinct Proboscidea. Courtesy of Professor Osborn



Jaw fragment of an anthropoid primate found by Mr. Barnum Brown in the Middel Siwalik beds. Remains of the higher Primates are very rare fossils in any of the Tertiary formations, but of extreme interest because of their bearing on the problem of the ancestry of man. The three specimens secured by Mr. Brown add materially to the scanty evidence available from the Siwalik beds. They are being carefully studied and compared by Dr. William K. Gregory and Dr. Milo Hellman and will shortly be described. These illustrations made by Mr. Malcolm Jamieson under their direction, is published in advance through their courtesy. The drawings show the top and inside views of the jaw fragment, natural size

not so high as they are now. The formation has shared in the later upheaval, so that it is exposed in a long range of considerable mountains, the uptilted edges of the strata facing toward the central ranges. There are immense exposures, most of them as barren of fossils as they are of vegetation, but here and there are areas or pockets where fossils are to be found. Some of these areas were known to the Indian Survey and we are deeply indebted to the Survey for information as to their location. Others were discovered by Mr. Brown in the course of extensive prospecting. The best season for such work is the late winter and spring; in the rainy season of autumn nothing can be done, and summer is almost unendurably hot.

The Siwalik Fauna belongs to the later part of the Tertiary, or Age of Mammals. It was at one time supposed to be a unit, but later researches, especially those of Dr. Guy H. Pilgrim, have shown that it consists of three distinct stages, covering the later Miocene and Pliocene. The middle portion is about equivalent to the famous Pikermi beds near Athens, Greece; the lower division begins with the Sansan and Simorre faunas of France; the upper Siwalik beds compare with the Montpellier of France and Val d'Arno of Italy.

These Siwalik faunas give a fairly consecutive history of the life of India from the middle Miocene to the end of the Pliocene. Through comparison with the record in other parts of the world we get a good line on the origin and dispersal of various races of animals during this time.

The finest series in Brown's collection is that of the proboscideans, including elephants, stegodons, various kinds of mastodons, and dinotheres. Of these there are 142 catalogued specimens, including five skulls.

Two mastodon skulls are nearly complete and of very large size; one of them has the tusks almost entire. There are also two stegodon skulls, equally large, one of them with the

tusks preserved. These four skulls are from the Middle Siwaliks. From the Lower Siwaliks there are numerous jaws and teeth, and one skull with tusks complete but not full-grown. From the Upper Siwaliks was obtained a large series of palates, jaws, and teeth of stegodons and primitive true elephants.

An extract from one of Mr. Brown's letters shows some of the obstacles overcome in collecting these skulls. "Some of the difficulties I have encountered in making this collection will interest you. It took one week to build a passable road for carts out of the bad lands and then required four bullocks and twenty-one men to move each mastodon skull. Fourteen days were consumed in transporting these skulls sixty-five miles, thirty-five of which were without road. The Indian countryman does not know how to work except in the grain field, and as he eats nothing but bread and chili, he has the strength of a small boy. . . Traveling is done at night now, for the daily temperature in the Punjab averages from 100 to 115 in the shade, and around 200 in the sun. It is the most taxing heat I have ever endured. . . . It is difficult to secure adequate boxing lumber for big specimens. Part of my material came from America and the rest had to be sawed by hand on the spot. I have used flour paste for bandages, as plaster is not obtainable."

Three jaws of anthropoid apes are of extraordinary interest because of the evidence they give regarding the evolution of these animals and their relation to the line of human descent. Mr. Brown's exact records of locality and geologic level show that these three specimens come from three successive horizons or geologic stages, and the teeth of the three indicate in some respects a progressive evolution from first to last, in a direction leading more toward the type of the modern gorilla and chimpanzee than toward the human type. If these jaws are really in a line of descent, it is one that points not so much toward man as toward the gorilla.

There are several antelope skulls and two of the singular extinct giraffoids, one rhinoceros skull, and three or four of hippopotami. There are two or three skulls of the three-toed horse, one of them with an associated skeleton that is probably nearly complete. Remains of carnivorous animals are extremely scanty, but there is one good skull of a very rare primitive carnivore (*Dissopsalis*), of which only a few fragments of jaws had previously been known. In addition to the series of skulls, about forty in all, there is a great number of jaws, fragments of jaws, and teeth of various animals, some of which, when carefully studied, will doubtless prove to be new or rare types. A point of especial value to the student is that the exact locality and distance above the base of the formation is carefully recorded for every specimen, great or small, in the whole collection, so that each can be placed in its exact time relation, be it earlier, later, or of the same age as that of others of its kind.

It has been a common criticism of the older palæontological researches that specimens in an evolutionary series were arranged arbitrarily in accordance with their progressive structural or anatomical differences, but that there was no evidence that these differences coincided with their real geological succession or sequence in time. The criticism was sound enough as applied to the older work, which followed too much the methods of comparative anatomy and traced the evolution of

structures but not the real evolution of a race of animals through mutations of species in successive stages of geological time. It is not true as applied to the more recent work in America, where, with exact data for every specimen, the progress of the race is traced continuously, through comparisons and averages, often based upon some hundreds of specimens from each geological level. It is this kind of work that we hope to do with the Indian collections, and to obtain more exact and more certain results as to evolution, migration, and extinction of races than has heretofore been possible. We shall also be able to make direct comparisons with the collections from Mongolia and China, and with those which we hope to secure from other regions.

In addition to the mammalian fossils, there are skulls of crocodile and gavial and a large part of the carapace and skeleton of the huge extinct tortoise (*Colossochelys*) of India, thought by some to be recalled in the ancient legends that couple the elephant and the tortoise as gigantic figures in Indian mythology.

Mr. Brown's collection is not so large as those in the London and Calcutta museums; but some of its specimens, notably the skeleton of the three-toed horse *Hipparion* and the skull of the primitive carnivore *Dissopsalis* are much finer than anything of their kind heretofore found in India, and some of the skulls of proboscideans and other large animals are quite as fine as anything in the older collections. It gives us a magnificent representation of this classic fauna, will make a splendid exhibition series, and will be of very great importance in researches upon fossil mammals.

Sketch made by Prof. Edward Forbes in one of Dr. Hugh Falconer's notebooks. It shows the earth resting upon the head of an elephant, which in turn is supported on the back of a tortoise, as the ancient Indian cosmogonies declared

Hainan

AN ISLAND OF FORBIDDING REPUTATION THAT PROVED AN EXCELLENT COLLECTING GROUND

By CLIFFORD H. POPE
Assistant in Zoölogy, Third Asiatic Expedition

EARLY in November, 1922, we left Peking for the island of Hainan, China's southernmost territory. First to be mentioned in the party is our artist, Mr. Wang, who had for more than a year been making drawings from life of Chinese fish, reptiles, and amphibians. He had already stood the test of work under great difficulty and capture by bandits, so we felt we could place full reliance upon him.

Next came our assistant, whose name was also Wang. Though only twenty-three years old, he had attended to the purchase and preservation of thousands of specimens. Wang not only showed skill in this work but did very good skinning; he too had faced bandits. Kang and Jong, though new to our party, were tried "taxidermists" and promised to keep up their end of the work—trapping and skinning.

On the fifteenth day after leaving Peking, we disembarked at Hoihow, Hainan's only port. I soon decided to head for Nodoa, a small inland town situated in the hilly country intermediate between the island's rolling northern plain and its wild southern highland. Members of the Hoihow branch of the American Presbyterian Mission not only gave much-needed advice, but actually hired a boat that would take us to Fa Hi, the head of navigation on the Golden River. We reached Fa Hi after three days of slow traveling up the river, and then a two-day journey overland brought us to Nodoa.

Late one afternoon, after a weary day's march through rolling, bushy country, we saw in the distance on a low hill foreign houses, and beyond, blue mountains standing out against the sky. Our porters made a bee line for these houses, not even waiting for directions. Of course, foreigners were coming to see foreigners! Once inside the compound, I was greeted by name and told that my dinner would soon be ready. The missionaries at Hoihow had sent a message and so we were expected. Mr. Leverett showed me a room that he said was to be mine and also an empty one in which we might store our equipment. In time, not only half of his bungalow had been turned over to us, but also various rooms in other buildings. We even invaded the hospital compound and before we were ready to leave, it seemed to me that we had used, in some way or other, every bit of the entire compound. Doctor Salsbury's assistant very patiently put up with bad odors resulting from the preparation of bats, rats, porcupines, hares, muntjacs, mongooses, genets, wild cats, wild pigs, monkeys, a varied assortment of squirrels, and many other mammals, all of which took place in the room next to his.

My thankfulness increased and also my surprise, for the Chinese had only discouraging tales to tell of the supposedly dangerous interior. It is said in Peking that the Hainanese have short tails and live on snake meat.

A typical central Hainan landscape.—The ornament in the foreground is a native cart. The screeching of these carts, though ear-splitting and nerve-racking, is effective, the natives assert, in frightening away evil spirits. When a few Hainan roads have been traversed, it is readily understood why such carts are used. They are perfectly adapted to their environment and well able to cope not only with the roads but with the lack of roads, the crossing of flooded paddy fields or newly cleared areas being easily achieved. Because of the enormous size of the wheels, the shocks caused by small holes and bumps are hardly noticeable, while the effects of the deep mud holes and the many gullies are lessened by the snail's pace of the draft animals

Even in Hoihow it was hard to get a "boy" sufficiently venturesome to make the journey with us as interpreter. The one we finally induced to accompany us, proved, before the end of a week, to be unable to cope with the local dialects and was therefore useless. We soon learned something of the difficulties. In Nodoa, which is the district's market town, no less than five distinct dialects are spoken—one for the town itself and one for each point of the compass. The so-called Mandarin spoken by the people of Nodoa is a corrupt form of the northern language. Hainanese, Hakka, Domchiu and Lim-ko Loi, Cantonese, and the local Mandarin all may be heard on the one "street." The missionaries have to study three and four dialects.

Mr. Leverett, anticipating my need for a local man to act as both guide and interpreter, had engaged Ah-sen, one of the "old, faithful" servants of the mission. During the following months Ah-sen handled nine dialects for me. Some of these could justly be called distinct languages. He could not write Chinese nor could he speak a word of English, but he knew a little northern Mandarin. No other Chinese in the district could speak so many dialects, nor was any quite so courageous as Ah-sen. He was invaluable. While with me, he had two encounters with bandits and congratulates himself on having come through with his life and without having taken that of a single bandit—a distinctly Chinese way of thinking. Ah-sen was famous for two exploits: once he had carried water, bare-footed and bare-legged—but with an old, high silk hat balanced on his head! On another occasion, in his "table boy" days, he had appeared at dinner, tray in hand, and a discarded corset drawn snugly about his waist.

Through the cooler winter months we spent most of our time studying and collecting mammals, but before February had passed, hot weather set in and we turned our attention to reptiles, amphibians, and fish. There were some days of warm weather before the endless rains began, and during these few days fish collecting was good. All the creeks and small rivers were so low—a result of the dry winter weather—that the fish were trapped in the deeper pools. The Chinese raced with us to the best places. They dumped quantities of lime into the water and thus forced the fish to the surface. Only a few days of the mild weather had passed when the spring rains came down; the thin trickles of water that barely connected the pools became torrents; and the fish that had escaped dynamite and lime were liberated.

With the mission compound for a base, ponies at our disposal, and the missionaries ever ready with advice and help, we were fortunate indeed. Kang and Jong were busy setting out and taking in traps, bargaining with local hunters, and skinning, while Wang was occupied with the boys, many of whom had become expert in catching snakes and frogs. A local man had been hired to help with the trapping and had himself become a good trapper. One day he put down his bag and, cautiously opening it, took out a rat trap in which a large cobra was securely caught by the neck! Ah-sen was kept more than busy hunting and circulating the news among local hunters that the new foreigner at Nodoa would buy all kinds of animals. If the village people were not reminded frequently, they would stop bringing in their catch. Two large cloudy leopards were killed and eaten on a mountain only seven miles from Nodoa. When Ah-sen asked the hunters why they had not brought the animals to us, the men said they had not been sure that we wanted leopards.

Though totally illiterate, Ah-sen could converse in nine tongues and was the only man who would do night-watching alone. Ordinarily watchmen work in pairs, but Ah-sen drew a double salary because he dared watch unassisted. Once he wandered north to Shantung and at Chefoo was employed as table boy in a foreign household. To Ah-sen is due a great deal of the credit for the collection of 1150 mammals taken out of Hainan by the Third Asiatic Expedition

At one time the Nodoa merchants accused us of having cornered the wild-cat market. To these Chinese each kind of wild animal has its own peculiar virtue as a medicine or tonic; therefore each species has a more or less definite market value. Monkeys, though common enough, are expensive and especially hard to secure because of the great demand for "monkey

"Taxidermist" Jong and assistant Wang are skinning a python (*Python molurus*). In spite of rumors of gigantic snakes on Hainan, none of the several pythons secured exceeded twelve feet in length. Python steak was tried and found to be delicious. There is always a ready sale for the meat, and it is said that the gall has remarkable medicinal value. Pythons though not extremely rare, are uncommon and hard to catch. They are generally discovered and held at bay by dogs

paste." We are told that this medicine is made of the entire animal. After a monkey's whole body—bones, hair, skin, and all—has been reduced to a uniform consistency by some special process, the resulting compound is administered to the decrepit old and the lazy young. The monkey is one of the most active and agile of animals and the "paste" certainly contains the very essence of monkey. He who eats the "paste" will, it is believed, become more active and agile.

In the case of animals having this set market value, purchasing was easy, but when it came to buying an uncommon toad or lizard or snake—well, the problem was far from simple. Any little slant-eyed boy would be glad of the chance to earn the fraction of a cent by gathering a few common frogs, but if a large or rare creature was brought in by a farmer, we hardly knew what to do, and generally left the decision to Wang. Under such circumstances, Wang, apparently not even deigning to turn from his work—thus appearing to be as unconcerned as possible—would quickly size up the object by glances out of the corner of his eye. The captor of the prized specimen would, on his side, lose no time in trying to impress Wang with the scarcity, difficulty of capture, and good condition of the animal. The next stage would be an effort on the part of each to force the other to name a price first—neither having the slightest idea of the other's conception of a

The cobra's attention is being attracted by assistant Wang, who stands just outside the picture. This is an example of the smaller and common kind of cobra found on Hainan. A specimen of the larger variety was not secured although a headless skin measuring eleven feet was brought in by a farmer. It is this large kind that is dreaded by the natives, who sometimes carry pieces of sulphur around with them as a protection against attack. The Chinese are very fond of snake meat, and discarded bodies were often taken by them

Scene on a stream fished by the Third Asiatic Expedition. The boat, built by popular subscription, was to serve as a ferry. The men are soldiers who came along to guard the gentleman (not in picture) who volunteered to show us a good fishing stream. Mr. Li dared not go even a short distance from Nodoa alone for fear of being kidnapped and held for ransom. He comes of a wealthy family

From this compound, at the very edge of a central Hainan forest, pioneering Cantonese manage one of their new tobacco plantations. Kang, one of the "taxidermists" of the expedition, made the compound his headquarters for many days. These thatched houses, with walls made of upright saplings, are the coolest and most economical houses that can be built. The compound is protected by a living stockade. In the center of the picture a few skins may be seen sunning

fair figure. After some moments of deadlock, the one finally forced to name his price would have to bear the brunt of the fierce sarcasm certain fairly to radiate from the other. For instance, if Wang had, as a starter, offered fifteen cents, the farmer would immediately have appeared to be either mortally wounded in pride, overcome with burning disgust, or choked with convulsive laughter at the very idea of such a ridiculously low price. If the farmer had been forced to name his price, Wang in his turn would have shown similar symptoms of varied and violent emotion. After many minutes of alternate emotional explosions the purchase would be concluded by Wang shouting after the fast-disappearing and thoroughly disgusted Chinese that his last price, though ridiculously high, would be given because—and here would follow a long series of apologetic and conditional excuses for giving in, duly punctuated with anything but complimentary remarks about the mental, moral, and physical make-up of Hainanese in general and one snake-catching farmer in particular. In all such bargaining the figure finally arrived at is sure to be about half-way between the two original conceptions of value. One wonders why it would not be simpler at the very start to subtract one figure from the other, divide the difference by two, and add the result to the smaller sum, thus arriving more promptly at the inevitable half-way point.

Although Mr. Wang is a thoroughly trained artist, he had always drawn in a purely Chinese school; never before joining us had he been introduced to scientific conceptions and methods in art. It can barely be seen that Mr. Wang holds in one hand two brushes. He changes from one to the other without putting either down or using his left hand. He is able to hold even three brushes at once, easily shifting them about by movements of the fingers. By no means does Mr. Wang consider this sleight of hand, but merely one of the numberless things that every well trained artist must be able to do. The frog being drawn is in the glass vessel on the table at the right

Through all the many ups and downs of our efforts while on Hainan, Mr. Wang worked steadily, never for an instant becoming slack. He drew with a steadiness that only an Oriental can show. One afternoon he came up to me with a most worried expression—something unusual for him—and told me that the toad on which he was working appeared to be seriously ill—yes, but he hardly dared breathe it, the creature was already almost dead! I hurried with him to see just what could be the trouble. Sure enough, there it lay all rigid, its legs stretched out in a pitiful manner. Could it be that the toad had actually "passed on?" Then Mr. Wang began sadly to relate how it had happened.

"About an hour ago," said he, "the

A bridge on the highway to Nodoa.—This was a favorite place for robbers to lie in wait. One robber, taken here, was duly tried but, though found guilty, was granted further trial in a higher court. However, on his way to the district city, he got no farther than the scene of his crime. Here he was asked to step to one side—he took his last step. The three men with hats are doubtful as to the prudence of being photographed by the foreigner, but the one on the right, an old mission servant, is quite familiar with cameras

toad began to scratch its sides and rub its mouth in a peculiar way. I couldn't imagine what was wrong. 'Surely it is suffering or is very sick,' I thought. Soon a thick substance began to ooze out all over its body. This puzzled me still more. Then I saw what I could hardly believe,—tears appeared in its eyes and I told myself that the poor toad must be actually crying. I felt sorry for it and said—'That's all right; don't cry, don't cry—you mustn't cry!'"

All his encouragement failed, however, to save its life, for the creature had been chilled while shedding its skin. But how should Chinese artists know that toads shed and eat their skins? When first asked, more than two years ago, if he would go in the field with a foreigner to draw living animals, Mr. Wang wanted especially to know whether he would have to handle snakes. That was one thing he could not do. Last year it was most amusing to see him lovingly caress and nurse a little snake he was drawing.

A remarkable and beautiful tadpole, its body a mixture of rich browns, was brought in. On its back was a delicate pink frill which even the weakest current swayed. The two tiny legs with their fully webbed feet were kept moving in a truly unusual manner—not as ordinary polliwogs are wont to move theirs. Mr. Wang became interested at once. Surely this tiny creature could not be merely a

tadpole; certainly it was the child of some weird dragon! So, day by day, as he watched the development, Mr. Wang gave rein to his fancy. What manner of strange fog dragon[1] would it turn into? Its parents were certainly hidden deep in some wild jungle! But alas, what disappointment! As the limbs slowly developed, the rich colors blended and faded, finally disappearing altogether. Ordinary shades of dull green gradually appeared and the head assumed a decidedly "froggy" aspect. All Wang's dragon dreams were shattered and quickly melted away. We had before us only a tiny, ugly specimen of the commonest frog on Hainan, the frog that nightly makes the air alive with its incessant calling from the paddy fields.

In the spring a band of about one hundred deserters worked their way inland from the coast and threatened to give trouble. They laid an ambush along the highway one day and, after blowing off a sergeant's head, looted the loads of some fifty carrying coolies. The ten privates of the command had dissolved upon seeing their leader fall to the ground headless, and, of course, the defenceless coolies wasted no time in disappearing. The mission suffered a loss of property valued at $500. Worse than this, such a bold attack, perpetrated so near, threatened to cut off our line of supplies. Carriers did not dare to travel that road alone and there was no other. For some time we had to take turns in escorting loaded coolies through this dangerous region. No one knew just when the outlaws would return or others appear. To make things worse, a feud broke out in Nodoa. The first victim was rushed to the mission hospital with a stab through the kidney—all had happened in broad daylight on a crowded street. I was strongly reminded of the doings in and about a small town in my native state of Georgia. The spring fighting season had evidently opened and from then on the monotony of collecting was broken by frequent rumors of battles and raids.

The intense heat and the violence of the sudden storms made work during the day difficult. Foreigners who have lived in Indo-China and latitudes as far south in the Orient well know how carefully the white man has to guard against the heat of spring and summer. Yet one often passes Chinese working while the noonday sun beats down upon their bare, shaved heads. One feels foolish beneath a thick pith helmet and wet towel and is tempted to find out by experiment just how much truth there is in the belief that a foreigner cannot stand the sun. However, experiment invariably convinces one that though the Chinese farmer may be quite sunproof, the foreigner is not. The Chinese sometimes catch small fish and snails by bailing out shallow swampy stretches. This they will do in the middle of the day under the hottest sun. Often a whole village will appoint a time for fishing and, putting aside farm work for the day, descend upon a stream, shut off a section from above and below, and then make a raid on the fish, the men working in the deeper pools with nets and the boys among the rocks and grass in the shallows. As the day goes on, the fish become more and more exhausted from constant fright and gradually fall victims to either the boys or the men.

In the preparation of the rice fields it is necessary for the men to wade

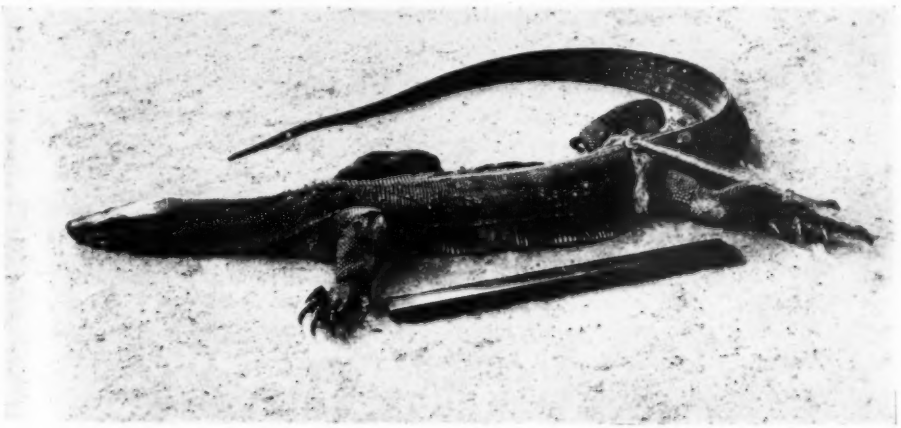
[1]In certain parts of China salamanders are called by the natives foggy-air dragons. They are worshipped; incense is burnt before their haunts; and people kowtow to them because it is thought they control the rain. During the rainy season one might safely catch them without arousing suspicion but let a drought set in, and the part of prudence is to leave them alone.

around in the souplike mud of the flooded fields for hours and hours and one soon becomes convinced that the skin of these farmers must be as waterproof as their heads are sun-proof.

The hot season, when work in the day is most difficult, unfortunately coincides with the fighting season, when night work is dangerous. All the patches of jungle have villages in them and at night the roads are carefully guarded and kept clear of stragglers. Lookouts are posted on high places and, because of the vigilance of the watch kept at all quarters, it is the part of prudence to be extremely careful as to prowling about after dark. One is more apt to be shot for a robber than taken by robbers, and the Chinese cannot be persuaded to go about at night.

Our collection steadily grew. Considerably more than 100 species of reptiles, amphibians, and fish were represented. A large series of all the common forms had been secured. Besides specimens we had measurements of all the mammals, many photographs, and abundant notes. Mr. Wang had illustrated the life histories of 15 species of amphibians and had painted many fish. About fifteen local men—cooks, frog catchers, and fishermen,—had helped in the work, while innumerable hunters had taken part in the collecting of our 1150 mammals. Countless boys were responsible for the thousands of frogs, snakes, lizards, and the like, packed away in our tins.

Early in July news of the reassemblage in Peking of the members of the Third Asiatic Expedition reached me and I prepared to leave Hainan. It was not easy to part from the good people who had for so many months helped us in every way. Each member of the mission, not excluding seven-year-old Chalmers Salsbury, himself an ardent collector, had joined in making our efforts fruitful and our life on the "Isle of Palms" pleasant in every way. Not only the writer but the American Museum itself owes a debt of gratitude to these unselfish workers.



A good idea of the size of this lizard may be obtained through a comparison of its length with that of the foot-rule lying beside it. The Hainan monitor belongs to a dwarf race, and, though similar in appearance to its Indian and Malayan cousins, in size it is not to be compared with some of them. The monitor, a big bluffer, is quite devoid of poison and harmless in spite of its habit of thrashing the keen tail about and blowing ominously. The natives believe that anyone struck by the whiplike tail is in danger of "dying about ten days later"

Through the Yangtze Gorges to Wan Hsien

By ANNA G. GRANGER
Third Asiatic Expedition, American Museum

"WAN HSIEN! The place that gives us more worry than any other spot in China!" said Mr. Willys Peck, first secretary of the American Legation in Peking, when he learned where the past winter's work had taken the American Museum's party. Doubtless the legation is concerned about the unsettled state of Szechuan Province, but the traveler who ventures into it soon loses consciousness of its protecting arm and learns to be his own diplomatist as fast as he can. Almost the first remark that the few foreigners in Wan Hsien made to me on my arrival in that city of ten thousand smells (as everybody dubs it, although the literal translation is "ten thousand district") was, "You were brave to venture down here when you didn't have to come." Two American gunboats, stationed alternately at Chungking and Wan Hsien, seemed alone to offer a definite zone of safety, and even one of these was recently fired upon by bandits when the captain, exercising his prerogative in releasing a Standard Oil junk which had fallen into their hands, incurred their displeasure. In this case the outlaws paid dearly for their temerity.

Such was the place we were headed for on the evening of November 9, 1922. Mr. Granger's experience in this Upper Yangtze valley in the preceding year had prepared him for the possibilities in the line of moving armies and flying bullets which awaited us, but for me the trip had all the zest of the unknown.

The first stage of our journey, the overland trip from Peking to Hankow by rail, should have been accomplished in thirty-six hours. All went well until the second evening. We were just retiring for the night when the train came to a halt and remained at a standstill the next forty-eight hours, the interval being required to chase an army of bandits numbering several thousands from the immediate vicinity of the railroad tracks not many miles ahead of us. Throughout the first day of our stay on the siding, trainloads of Chinese soldiers from the North passed us on their way to the scene of action. When finally we were able to proceed, it was dark, and although we all were anxious to see what had taken place in the area where the bandits had operated, we could make out nothing except the numerous red glows on the horizon indicating the spots where buildings were still in flames.

November 15 was a late date to be thinking of securing good accommodations on the Upper Yangtze steamers. The large boats had long since stopped running on account of the low water. The delay of forty-eight hours in the middle of the province of Honan caused us serious concern, and we were greatly relieved to find, upon reaching Hankow on the morning of the thirteenth, that the steamer "Kiang Wo" would leave for Ichang that same evening. Four of the Chinese members of the party had been sent on ahead to Hankow. These were Mr. James Wong, our interpreter; "Chi," the taxidermist; "Buckshot" (so christened by an officer in the American Guard in Peking, for whom he had worked as a boy); and "Huei," our accomplished cook.

"Chow," the table boy and general handy man, had made the journey from Peking with us.

By vigorous efforts on the part of all, banking business was attended to, additional supplies of tinned goods bought, and our formidable array of baggage transferred to the upriver steamer by nightfall. Hankow carrying coolies are a difficult set of men to deal with. It took all of Mr. Wong's unfailing good humor, tact, and much talk to effect a reasonable bargain for their services. When the last packet was put aboard, it was with a great sigh of relief that we ourselves clambered up some steep stairs aft. We managed to reach the cabins assigned to us without stepping on any of the sleeping coolies who paved the way. It was past the tourist season. We were the only first-class passengers, and no better means of entrance was provided.

The next three days gave everyone opportunity to be lazy. Chi, Huei, Chow, and Buckshot spent much of their time playing mah-jongg. Mr. Wong had long confabs and several dinner engagements with the ship's compradore, a man whose good will it is well to cultivate. Mr. Granger and I found endless entertainment in watching the native life along the river, as the steamer, following the deepest channel, went close to one shore or the other. Often we were near enough to be within speaking distance. At such times there was always a crowd of children running along the bank, crying out to us to throw them empty bottles. The captain, as well as we, tried to hurl some over to them, but never succeeded, all falling in the swift current, much to their disappointment and ours. Tossing articles shoreward to the eager children is one of the regular diversions for passengers on the Hankow-Ichang run.

In certain stretches of this part of the Yangtze, high mud dikes, thrown up to keep back the summer flood, hide everything from sight except the tops of the tallest trees, but for the most part we had an uninterrupted view of the low flat plains and could see the Chinese performing their autumn chores about their farmhouses. We could not help feeling sorry for some of these industrious people when we observed how steadily the river was stealing away their property. Even as we passed, many feet of earth tumbled into the water, intensifying its chocolate color and adding to its burden of silt. I find the following entry in my diary for November 16: "Saw a cormorant, blue heron, swan, besides literally clouds of duck and geese." Mr. Granger's notebook makes special mention of many birds seen at this same point in August, 1921.

The sky had been overcast ever since we had come in sight of the Yangtze, a condition usually prevailing as winter approaches. On the seventeenth, however, the sun shone. Also, the country became more hilly and interesting. The river banks, instead of being abrupt, here sloped away gradually from the water and were cultivated down to the farthest limit. Only such crops were planted as could be safely garnered before the summer rise. We anchored opposite the city of Ichang about three o'clock. This was fairly quick time, considering that we moved only from dawn to sunset. Unless there is a clear moon to guide, captains do not usually attempt to negotiate the ever-changing channel after dark. It is a common incident to hear of a steamer stranded on a sand bar.

The "Kiang Wo" had hardly come to a standstill in midstream when Monsieur Kaplain, then director of

View of the bund at Ichang, photographed at the time of medium high water. Extreme high water floods the bund

The Yangtze, taken from the bund at Ichang during the period of low water.—Under these conditions mud flats of considerable extent are exposed

posts at Ichang and formerly at Wan Hsien, stepped aboard to greet us, and to carry us ashore in his sampan as soon as we should be free. He brought word that the steamer "Shu Hun," flying the French flag, would leave for Wan Hsien at daybreak the following morning. Mr. Wong was at once dispatched to see if any first-class cabins were still available and, if so, to bargain for them with the compradore. Earlier in the season, while the large river steamers are running, tickets are sold and baggage is carried at a fixed rate, but when these boats are taken off and competition ceases, one is obliged to pay whatever the comprador may demand, and his price is frequently excessive. Mr. Wong was instructed to say that rather than pay an exorbitant sum, we would hire a junk. Fortunately we did not have to resort to this slow and dangerous method of reaching our destination. There proved to be ample room in the first-class cabins, but in the second- and third-class sections not space enough to make it possible for our Chinese even to spread out their bed rolls. However, as nothing else offered, and the Yangtze was getting lower every day, there was nothing to do but accept conditions as they were, and our men did so cheerfully.

Leaving Mr. Wong to complete arrangements, we went to have tea with Monsieur Caplain and his wife at their home, returning to the "Kiang Wo" for dinner, and later going over to the "Shu Hun" with Mr. Wong to sleep. During the little sampan ride from one steamer to the other, I was surprised to notice that Mr. Wong's pistol was more in evidence than usual. He explained that this show of arms was simply to insure our being taken where we wanted to go, and that, too, without any argument as to the fare. To my eyes, accustomed only to Northern Chinese all the boatmen looked capable of making daring holdups, and it was not difficult to picture how badly we would fare in a sampan on a dark night, surrounded only by those who turn a deaf ear to cries for help.

The "Shu Hun" had been under way about half an hour when I awoke and looked out to find that the marvels of the Gorge scenery were already beginning to unfold. Hastily donning enough clothes to keep warm and wrapping a steamer rug around me, I went out on deck. Captain Bienami, to whom we had had a card of introduction from Monsieur Caplain, was already about. He stopped to chat with me. It was quite evident that he had seen nature enthusiasts before and was accustomed to early morning apparitions! Mr. Granger was taking a much-needed rest, and could not be persuaded by any of my bursts of delight to leave his berth before breakfast was called.

The two days that followed were full of wonder and intense satisfaction at nature's handiwork, of awe in the presence of a waterway requiring so long a period of time in the making, and of astonishment at the powers of destruction still inherent in the mighty stream. We were fortunate in seeing the Gorges at just this season when, by reason of the low water, the precipitous sides of the chasm were revealed in their full, majestic height, and when the autumn colorings were upon all the various plant growths that find lodgment in these rocky uplifts, even in the most unlikely places. The beauty was enhanced by a bright sun, an all-too-rare circumstance in these parts. At times, owing to the sharp turns in the

river, we seemed to be traveling on a harmless lake, with further progress barred by encircling mountains. Not a ripple ruffled the surface, the great depth of the water apparently making the whole body move as one mass. Here one forgot its power. It was at the wider places along our course, caused by the palisades having slipped out of position, filling the bed of the stream with rock piles, that the dashing spray and vicious-looking whirlpools made one aware of the presence of a strong current.

It is no easy matter for a small craft to fight its way up this seething rapid (the Hsin T'an), even though under full steam and directed by a Chinese pilot who has attained his position only after long experience with the difficult waters of the Upper Yangtze

Going up the Hsin T'an (new rapid) gave us all genuine excitement. As has already been said, we were carrying a super cargo of human beings. Some of us were asked to place ourselves in the forward part of the boat, the better to distribute the weight. If there had been any means at hand for removing about half our number during the passage of the rapid, it would have eased our minds. Next, the woodwork immediately touching the boiler stacks was dampened to prevent scorching while the engines were under forced draft. Mr. Granger made some private preparations for the fray by taking off the heavy ulster he was wearing. In the event of an accident, which was not unthinkable, he felt it would be expedient to be as unhampered as possible. Finally everything on the lower deck was made tight, and our prow entered the seething water. Each of us now chose some fixed spot on the shore by which to measure our advance, and watched breathlessly to see which of the contending forces would be the stronger. The captain had said he wasn't sure he could "make it" under his own steam alone, and for several moments our boat showed no gain whatever, but just

when we thought that the water would conquer, we began creeping slowly ahead, and the struggle was won.

Captain Bienami came around directly afterward to enquire pleasantly if we had been sufficiently thrilled. We replied that indeed we had and that we didn't wonder that the mail for Wan Hsien, carried in tiny post boats, arrived at its destination frequently in a soaked condition. We then invited him to share a box of chocolates with which some good friends in Peking had provided us and which we had opened in celebration of the safe transit. One other box had served to beguile the idle hours on the side track in Honan. It was during one of these sociable moments with this most genial of skippers that we learned that the actual control of the wheel is not in the captain's hands, but is left to the Chinese pilots, who have attained their position only after many years of experience in dealing with the special difficulties of the Upper Yangtze waters.

We should have enjoyed continuing on to Chungking under this friendly guide had there not been work requiring our presence at Wan Hsien. We reached that city some time after dark on the nineteenth, too late to do more than hire a sampan, selected from the many that always swarm about so thickly as to hinder rather than facilitate disembarking, and put the camp equipment aboard it. This was not effected without some little unpleasantness. It seems that an attempt was made on the part of some of the ship's crew to prevent the removal of our goods unless an extra fee was paid. Mr. Wong was obliged to threaten to use violence before our men were allowed to proceed with the work of unloading. It is such unexpected altercations as this that make moving about in China a trial. The plan was to leave the steamer's side before she would get under way the next morning. Our four Chinese were glad to abandon their cramped quarters and to spend the night in the sampan, guarding the luggage, which would otherwise have been stolen. No one slept soundly for thinking of our early start on the morrow. A patter of rain, which we had been dreading, awoke us in good season. By five-thirty our hand grips had been lowered over the steamer's side and we ourselves had dropped into the sampan by descending a hatchway even more thickly strewn with human forms than had been the one on the "Kiang Wo." The nearest shore toward which we must go first was only faintly discernible when we said our final good-byes to the captain and pushed off. He waited until we had reached our position of safety, then the siren blew, and a distinctly eerie feeling settled over us as we watched the twinkling lights disappear.

We had been cautioned not to cross to Wan Hsien until the swells caused by the propellers had had time to go to the bank and return again, since many a small boat has been known to founder in the second commotion after safely weathering the first. We were content to follow instructions, especially on noticing, as it became lighter, that we were more heavily loaded than we had supposed, because of some freight which the boatman had added on his own account. About the time that our pilot decided it was safe to start to the opposite shore, another shower came on, which did not add to our feeling of well-being, for there was no shelter on our boat. Midway across we entered the swift water. Our course was directed diagonally upstream. The current took care of the rest, bringing

A view along the river front at Wan Hsien

us down again and butting us sharply against some sampans, by whose side we had to moor for want of a free space on the shore. The "excess" freight nearly slid off by the impact.

Daylight had now fairly come, or as much of daylight as Wan Hsien often gets before noon. While the men were busy separating the boxes which were to be taken to a place of storage from the pieces that were to go to the China Inland Mission, our headquarters, and Mr. Wong was getting in some of his Szechuanese jargon with the carrying coolies, I had time to look about. Happening to glance toward the river and seeing how madly it was careering along, I realized, as I had not in the half dawn when we were actually upon it, the danger to which we had been exposed.

If anyone wants to visualize the "pestilence that walketh in darkness," he should certainly visit Wan Hsien. It has the reputation of being the dirtiest city in China. We found it fully as

A river divides the town of Wan Hsien into two parts. During high water the Yangtze backs up in this stream channel to the full height of the bridge arch seen in the background

black as it is painted. It is loathsome yet to recall that first ride in a sedan chair from the landing place to the Mission. There is only one thing worse than being carried over the unspeakable filth and running the risk of being dropped into it, and that is to have to trail through it on one's own feet. Even along the fore shore and on the steep banks of the stream that divides the town, where one would think the sweet airs of heaven might predominate, the odors were scarcely less noxious than they were in the paved alleys and endless stone stairways within the town itself. Subsequent rides in other directions showed that outside of the compounds under the control of foreigners there is not such a thing as a clean spot anywhere.

During the time which it took our Chinese to prepare the ancestral hall of the Tan families at Yen Ching Kou for another season's occupation by the Museum party, Mr. Granger and Mr. Wong remained at Wan Hsien. It was necessary to pay respects to General Chang Tsong, commander of the Szechuan military forces in that city, and to the local magistrate. Upon the presentation of our credentials, a pass was issued, permitting travel in the neighborhood. This accomplished, we called on all the foreigners (they were only a handful) who had the ill luck to be billeted in Wan Hsien, and made the acquaintance of the officers on the gunboats, British as well as American. I should like to record that all of these people, including Mr. and Mrs. Darlington and their fellow workers at the Mission, were unfailing in their courtesies to us throughout our stay in the province of Szechuan.

It was not until December 21 that I made my first visit to the Museum camp at Yen Ching Kou. Mr. Granger came to Wan Hsien to accompany me. Practically a whole day is consumed in going between the two places, although the distance is only twenty miles.

The attraction of the ride consisted in keeping so close to the shore that we could land at almost any moment, and we were glad to alight several times, to warm our chilled bodies by a brisk walk. It was interesting, too, to watch the methods of propulsion which the Chinese have developed to overcome the swift current. Our crew consisted of two men and a boy; all three stood to their work during the whole of the four hours that it takes to reach Pei Shui Chi, the small town at the head of the troublesome little rapid known as the Fu T'an. By means of two oars attached by a loop of bamboo to upright pegs about two feet high, a bamboo tracking rope, which it was the small boy's lot to carry ashore at intervals, and several long poles tipped with iron and used to thrust into holes in the rocks, a forward motion was teased out of the water. The last-mentioned instruments have been used for so many generations of boatmen that in places the rocks are fairly honeycombed with holes four or five inches deep made by the repeated use of the same spots as points of leverage. When we came opposite the lower end of the Fu T'an, we had to cross the river. The two older men of our crew took the tracking rope, and with the assist-

Deep holes have been worn in the rocks where successive generations of boatmen have thrust their iron-tipped poles in order to force their sampans forward against the swift current

The sampan bearing the Museum party and flying the American flag is being tracked and poled over a difficult place on the Yangtze between Wan Hsien and Pei Shui Chi

A mute testimony to hard labor are the grooves worn in the stone by the bamboo ropes used by trackers

A section of rice paddies high up on the mountain face.—The entire slope was similarly carved. The T'an ancestral hall is seen in the foreground

ance of a Chinese from another sampan and of Mr. Granger too, our boat was hauled over.

Quite a sizeable stream, spanned by a beautifully arched stone bridge, enters the Yangtze at Pei Shui Chi. The same water flows as a small brook past the Museum camp at Yen Ching Kou. We were soon following up its course, —Mr. Granger and Chow on foot and I in a sedan chair. Before setting out we stopped at a so-called Chinese inn, in this case simply a matting-covered shed containing two tables, benches resembling sawhorses to sit on, a Chinese bed, called a *kang*, and the usual cement stove. Here we obtained hot water for our tea and delicious

native tangerines and peanuts to supplement our luncheon sandwiches. By three o'clock we were started up the twelve miles of stone-paved trail, narrow and in a bad state of repair, passing by highly cultivated mountain-sides that are truly nothing less than marvels of agricultural architecture. One slope must have had more than a hundred terraces carved upon its face, some filled with water, others planted out to vegetables, as is the custom in the winter season. Night shut down upon us about two-thirds of the way up. As I could no longer see where the pitfalls were ahead, I gave up worrying and contented myself with drinking in long drafts of the sweet-smelling mountain air. At about seven o'clock Mr. Wong's cheery welcome was heard in the darkness, and we knew that the Museum camp was at hand.

(In a later issue of NATURAL HISTORY Mrs. Granger will give an account of life as she lived it in a Chinese ancestral hall converted for the time being into a Museum camp, and of excursions to fossil pits in the neighborhood from which of old the "dragon" bones of Chinese medicine were taken and which more recently have supplied specimens of extinct animals to the Museum.)

The ancestral hall and a part of the village of Yen Ching Kou.—It was here that Mr. and Mrs. Granger lived while Mr. Granger collected fossils in the region

A black bear strolling by, at a distance of about thirty yards from the camera

In the Realm of the Kamchatka Black Bear[1]

By WALDEMAR JOCHELSON

Leader of the Ethnological Division of the Kamchatka Expedition of the Imperial Russian Geographical Society

THE Kamchatka Peninsula to the south of Petropavlovsk is at present almost uninhabited. The natives have either died out or were exterminated by the Russians. Only on the western shore are there three small villages, and one of them at the mouth of the Osernaya River was recently established by Russian settlers. From this settlement I had to ascend the mountainous Osernaya River to Lake Kuril, fifty-five miles from the shore of the Sea of Okhotsk.

The purpose of my going to Lake Kuril was to excavate the site of an ancient village which existed in prehistoric times on a small promontory on the eastern shore of the lake. This village was inhabited by natives of mixed blood—a cross between Kurilians and Kamchadal. Just as I had anticipated, I found there evidence of the historic and cultural connection of the old local population, on the one hand with the Kurilians, Ainus, and other ancient inhabitants of the Japanese Islands, and on the other—through the Kamchadal, Koryak, and Chukchee—with the Indians of northwestern America.

Our party consisted of myself as leader, Mrs. Jochelson, M.D., as assistant and physician to the party, and eleven laborers, of whom seven were Russians, three Kamchadal, and one Japanese.

The Osernaya River, with its slanting bed, rocky banks, rapids, falls,

[1]Illustrations by the author.

Unloading the boats, preparatory to ascending the rapids of the Osernaya River

and curves, forms a most difficult and dangerous route of travel. We had two boats and two canoes. One of the boats was for Mrs. Jochelson and myself; the other boat carried the tents, instruments, food, and other supplies. The canoes served for reconnaissance and errands requiring dispatch. It was very difficult to make progress on the boisterous river, particularly on the way up. Several times we had to disembark and carry our freight on our shoulders while the boats were pulled by ropes through the rapids.

While there are no human habitations anywhere in the country, we were amazed to find well-beaten paths in the forests and on the mountains above the river, as if there were numerous human settlements. But realizing that these were roadways made by bears, we walked cautiously amid the dense vegetation with rifles ready for action. We did not see any bears while following these paths, but we heard the breaking and cracking of bushes and tree branches, and on the ground we found left-over pieces of fresh salmon, the remnants of the bears' meals. The animals are very nervous and easily become alarmed. They have sufficient reason to be afraid of a man with a gun.

It is well known that at Lake Kuril and in its vicininity scores of bears are to be found. The abundance of fish and of many kinds of berries furnishes them ample food and favors their increase in number. The sparsity of human population is also favorable to the multiplication of the bears, although the few hunters of the coastal villages kill them annually by the hundreds.

After five days of painful effort we finally reached our destination. It was a windy day and our frail boats nearly capsized on the stormy lake, which is surrounded by the peaks of extinct volcanoes.

We were entertained every day by the sight of bears fishing and gathering

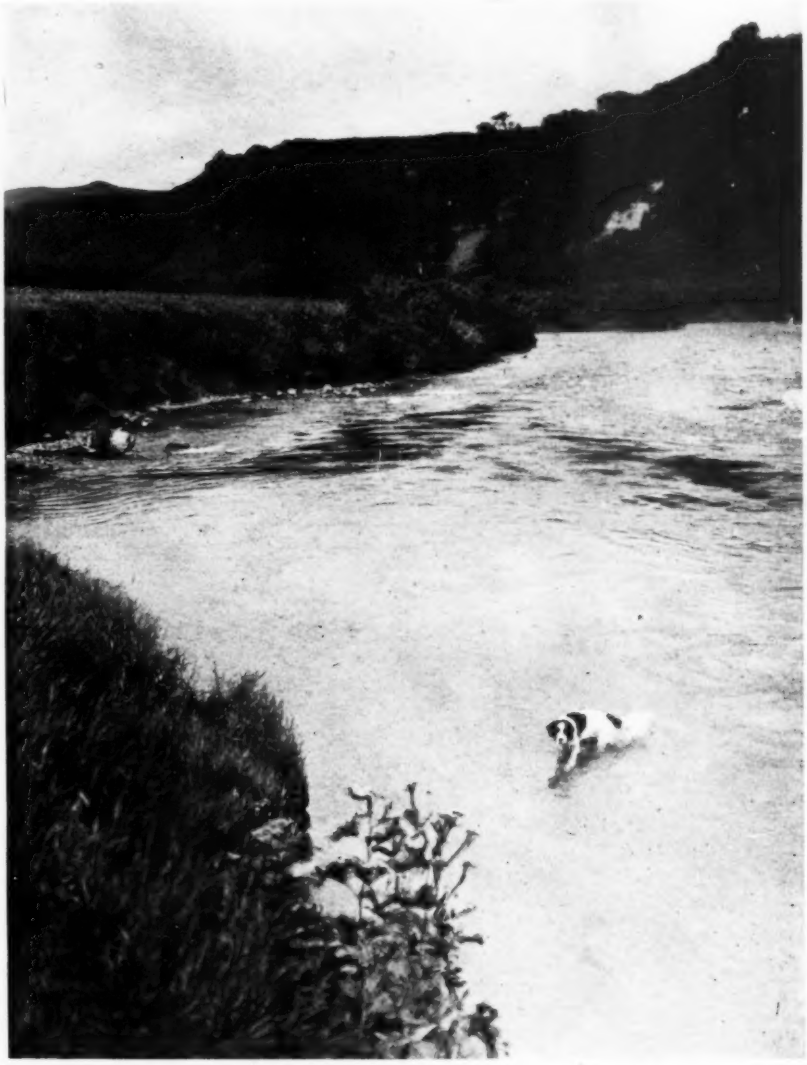
When rapids were encountered, the occupants of the boat disembarked and pulled at the ropes instead of at the oars

An inner pond in the Lake Kuril region, with Doctor Jochelson's encampment in the foreground

berries, particularly when we increased our field of observation by the use of opera glasses. The bears stood with their hind legs in the mountain rivers and creeks, and with their front paws they managed to throw out on the banks sea salmon that in order to spawn ascend the rivulets that flow into the lake. Then they went after their prey and, eating off the heads and spines, which are the most palatable parts of the fish, cast away the remainder. Their movements, turnings, leapings, and jumpings, were so amusing that we could not restrain our laughter.

My laborers were anxious to hunt bear, but I could not allow them to go on such an undertaking as my time was short and a government steamer was expected on a certain date at the mouth of the Osernaya River to take my party to Petropavlovsk. Only once I allowed two of them to go for a night hunt and they secured a little bear cub. The meat they cooked and ate.

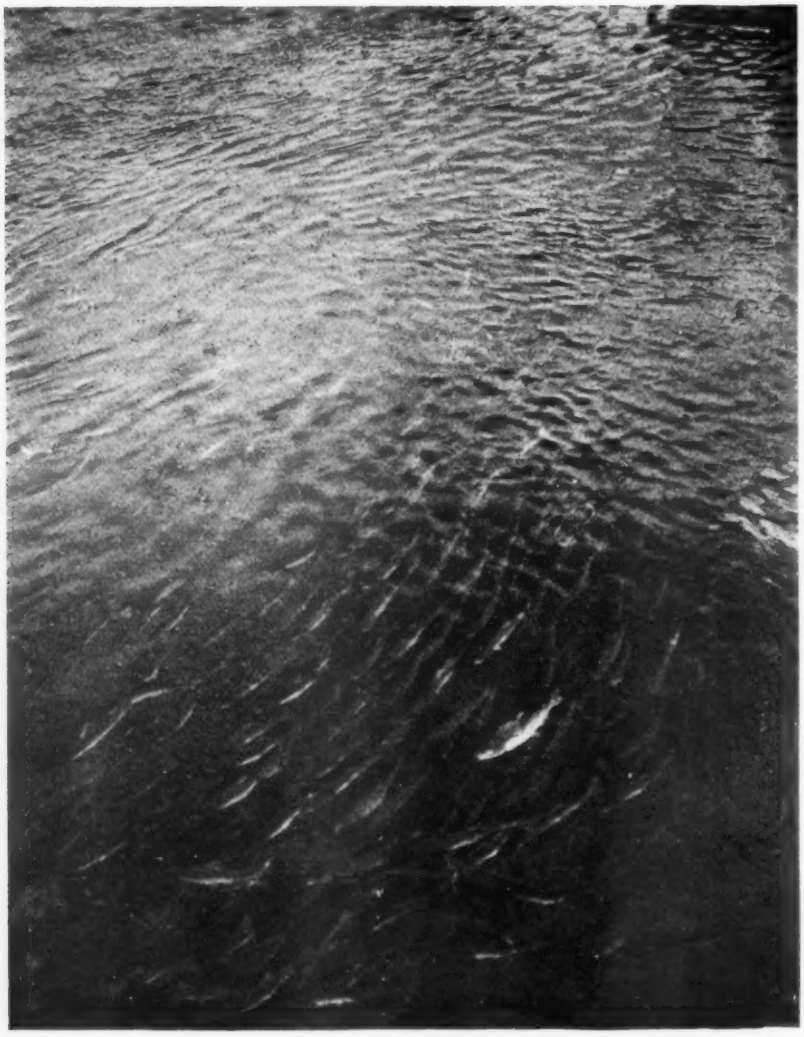
The morning of our contemplated departure from Lake Kuril, when all the specimens found in the excavations had been packed, the lids of the boxes nailed down, and the boats loaded, I was tempted to linger just a little longer upon seeing two she-bears with their cubs playing on the other side of a pond in the rear of the promontory. I accordingly delayed my departure until the afternoon and singling out two of the best marksmen from my party and equipped with a stereoscopic camera and a motion-picture camera, I started in the direction of the bears. We had to undress in order to cross the river in the rear of the promontory, and to carry on our heads the bundles of clothing, the rifles, and the cameras,



Doctor Jochelson's Newfoundland dog intent upon catching fish, a practice in which the bears of the region also indulge

so that they might not get wet. We reached the other bank of the river, dressed ourselves, and tried to pass as noiselessly as possible through the little jungle that led up to the open meadow where the she-bears were playing with their cubs.

We stopped on the outskirts of the forest and put up the cinema and stereoscopic cameras. As the bears were still too far away, I told one of my two men to make a circuit about them and frighten them from the rear so that they might come nearer to us. Both cameras were in readiness to take pictures when suddenly at a distance of about thirty yards appeared a young black bear quietly passing by. I quickly took a stereoscopic snapshot and was about to start with my cinema,



Salmon were abundant at the entrance of the lake

but the bear was frightened by the clatter of the falling shutter of the photographic camera and, instead of running away, rushed in our direction. We had no choice but to aim at his head and fire as he neared the cameras.

After ascertaining that the bear was dead, we looked around. None of the other bears were to be seen: they had been frightened by the shooting and had disappeared. As I could not remain on the lake any longer, I had to give up the idea of another attempt to approach bears with peaceful intent. The bear that was killed appeared to be not more than three or four years old. I took the skin and the meat of a hind leg for the laborers.

We returned to our camp late in the day and were compelled to spend one more night on the promontory. Next morning, our archæological mission fulfilled, we started on our journey to the sea.

Some Drums and Drum Rhythms of Jamaica[1]

By HELEN H. ROBERTS

SELDOM does one pick up a book dealing with travel among negro peoples and fail to find some allusion to their music, to their remarkable untaught ability to harmonize, or to the strangely fascinating effect produced by the complicated rhythms, especially of their drums, of which there are many varieties. The drums which attract the most attention are of huge size. Often their deep tones may be heard many miles and are conveyors of messages to those versed in their language. The hollowed tree trunk has provided the sounding cavity for many types, and while in some districts animal skins, such as those of the goat, furnish the vibrating membranes, in others nothing was so prized as the skin of a human being.

Throughout Melanesia as well as Africa drums play a very important part in ceremonial life. Some illustrated volumes contain pictures of huge hollowed-tree specimens standing on end in groves, almost as the original trees grew. These drums are played by priests who take as keen delight in the varied responses obtained from them as an organist in his different sets of pipes.

Although we have many photographs of these instruments and the museums contain actual specimens, and although we read of the weird effect their throbbing notes produce on the nerves and emotions of whites as well as blacks, practically no notation has been made of the rhythms, tempo, or tones. Most of the travelers who have heard them are either missionaries, to whose untiring efforts we owe the greater part of our knowledge of far-away lands, or scientific explorers,—both primarily interested in other fields, and rarely sufficiently trained in music to report in more than a casual way regarding what they hear.

I have always wished that I might have the opportunity of listening to those great drums and of feeling the mysterious effect of their rhythms. Although that experience has been denied me, I had the privilege recently of becoming acquainted with the drum as the negro of Jamaica makes and plays it.

Jamaican negroes are, despite all of Britain's civilizing influence, very African still beneath the veneer. They have retained many characteristics of their former home: words, superstitions, folklore, customs, love of music, remnants of songs sung with words now unintelligible even to the singers, peculiar methods of planting, of house-building, and of making musical instruments, and other mementos of their past too numerous to list. The people of the more remote districts, where little contact is had with the outside world, live in a manner scarcely changed since early slave days.

Immediately upon our arrival two days after Christmas we proceeded to Lacovia, hardly more than a "four corners" in the southwest-central part of the island. Although situated in the midst of great and very old plantations and near a log-wood dye factory,

[1]The information presented in this article was gathered during a field trip to Jamaica in the winter of 1920–21, made under the auspices of the Folklore Foundation of Vassar College and of the American Association for the Advancement of Science, for the purpose of collecting folk songs.

Lacovia is remote from any real town except that of Black River, an important port before the days when Kingston at the other end of the island wrested the supremacy from her, but now a quiet little community dreaming in the sunshine on the edge of the turquoise Caribbean, of the days of pirates and rich galleons, while it waits peacefully for the only occasional ships that now put in for coffee, allspice, and other produce, or to unload supplies.

A keg-shaped drum of native manufacture

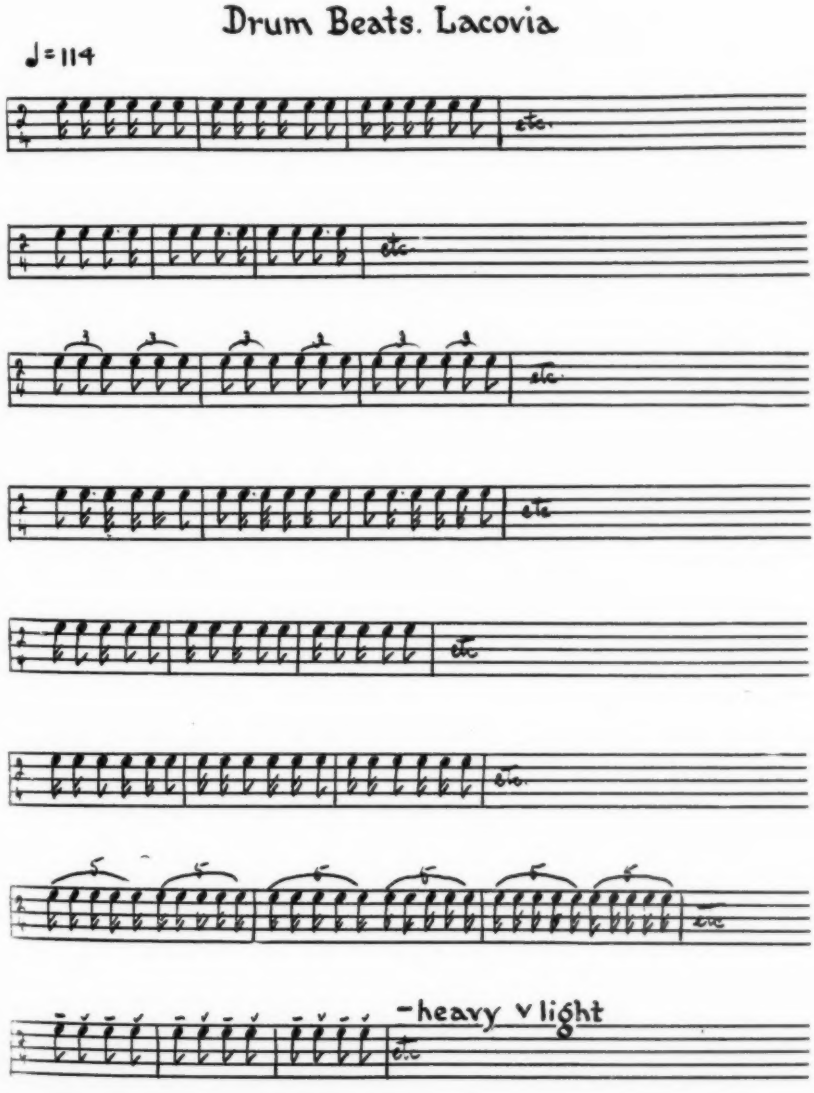
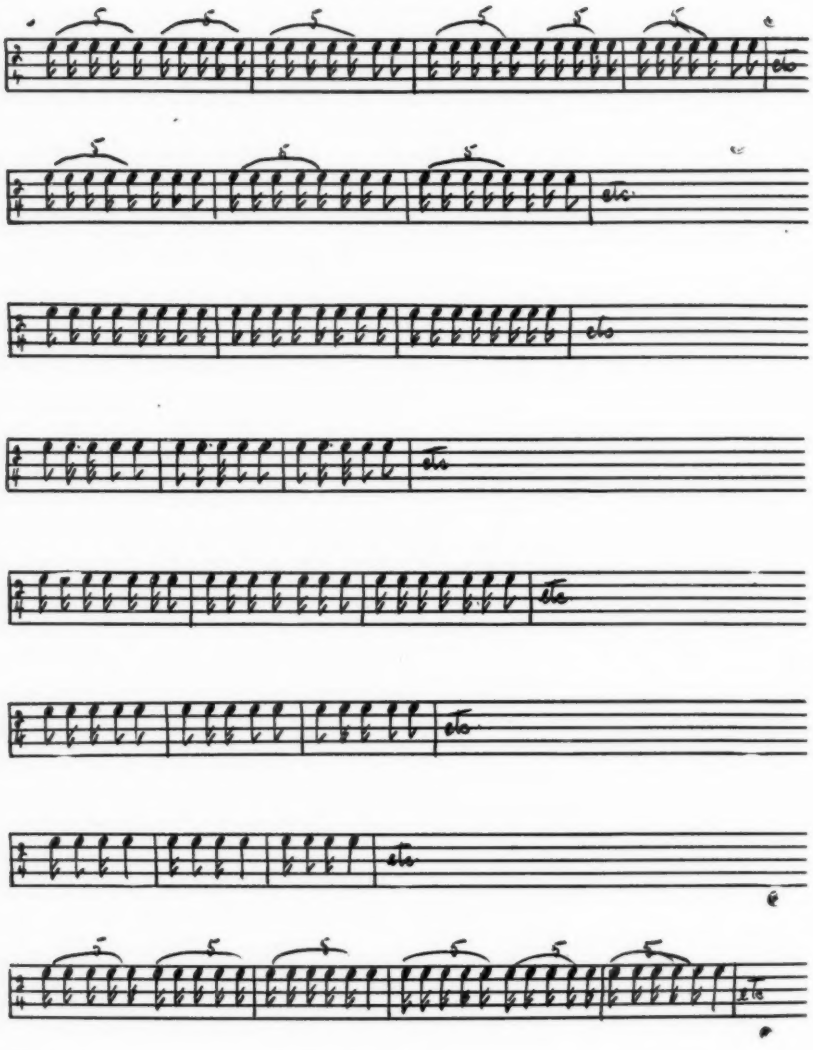
The negroes are still in the habit of holding some pagan festivals during the Christmas holidays, although the consent of the government is given reluctantly. It is generally admitted that the festivities unsettle the people for weeks afterward, and permits for the performances are granted to cover only a limited length of time. It is during the holidays, when factories and plantations make no pretense of work for at least two weeks and general idleness prevails, that the drums are beaten most,—in the public markets, along the roads, and at all sorts of gatherings, including revival meetings.

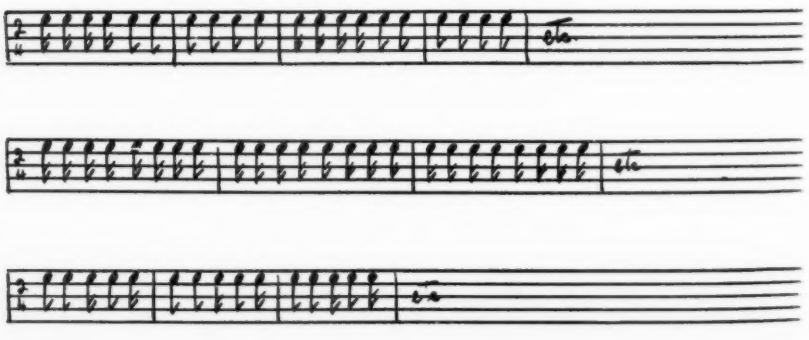
We found the John Canoe dance (a pagan survival) and other festivities in full swing in the back districts, although in the larger tourist towns these have to a great extent disappeared.[1] In the market places were erected hand-driven merry-go-rounds of ancient design upon which all but the very old rode with an utter abandon to joy in the motion, the drum rhythms, and the music. There were several little bands of strolling players that took turns in providing music for this popular pastime in the market place, near the estate where we were fortunate enough to be guests. The bands were usually composed of a flutist with an instrument of bamboo, a triangle player (who sometimes had a real triangle, sometimes merely a piece of iron suspended from a string), and two drummers, with what corresponded to side and bass drums. These, although of home manufacture—one was constructed from an old keg—were unlike most African drums in that both sides were covered with skin.

Although our visit to the market place attracted considerable attention, I succeeded in finding a seat not far from the merry-go-round, and after some time the novelty of my presence ceased to draw onlookers or to disturb the players, who may have taken my quiet sitting under a thatch shade as a sign that I was merely resting. During the hour that I was able to remain there, I succeeded in noting the following rhythms played by the side drummer, a few combinations achieved by the little untaught band, as well as four triangle rhythms. These were by no

[1] An article on the John Canoe festival is being prepared by Miss Martha Beckwith but has not yet been published.

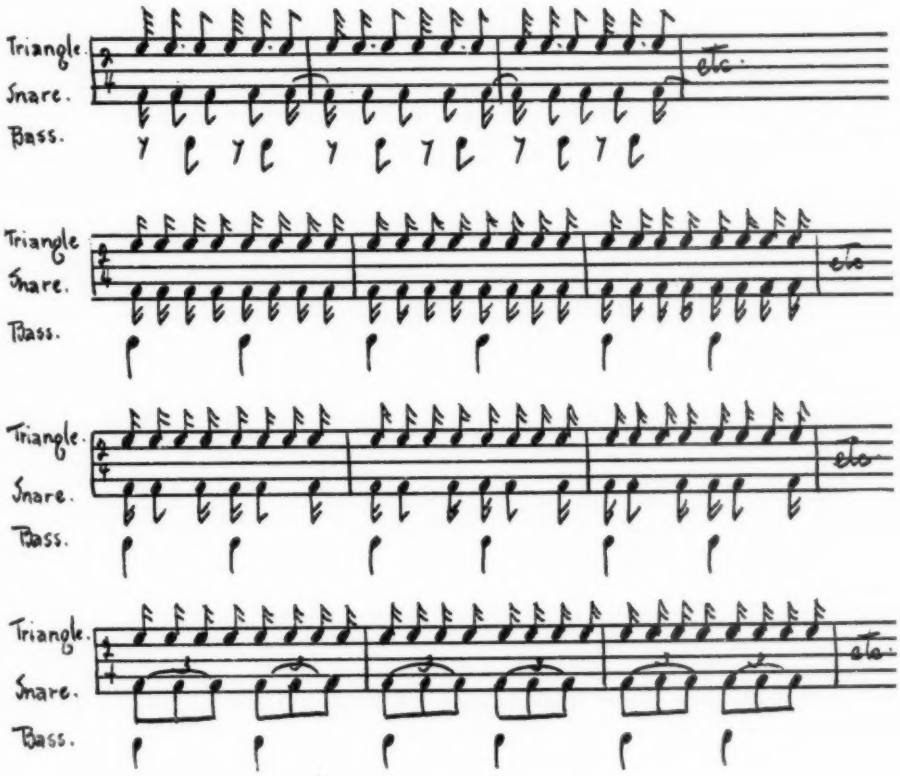
means all that were played in that space of time, for changes were constant, and while I was concentrating to hold in memory and note down one set of rhythms, another would often be substituted for it, which would be changed in turn by the time I had recorded the first.

The chief or side drummer was unusually musical, with a rhythmic sense rare even among negroes, whose feeling for rhythms of the most complicated nature is intuitive. I was not able to write down many combinational effects, otherwise his ability in holding his own and shifting his pattern while always keeping the beat would be more apparent. He later gave me information about the songs, and it was then discovered that his beautiful voice had a range of more than three octaves, for he had a rich and pure falsetto. His appreciation of melody and of harmony was very evident. When drumming, he

Triangle Rythms. Lacovia



Combinations of Beats. Lacovia

Triangle, Snare and Bass Drums



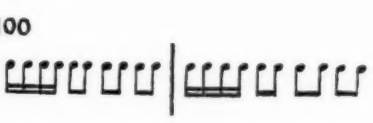
played as though inspired, his head turned to one side, as if he needed the keener hearing of one ear, while his rapt expression showed that he was oblivious to all but the task in hand.

The most significant feature of these rhythms and of the majority of others that I heard throughout my stay is that most of them revolve around two- and four-part meters, of which the two-part are the more common. The tempos of the pieces played for the merry-go-round were all about the same, as I have indicated by the metronome mark, and few if any other pieces moved more slowly. The movements might be described as a vigorous pushing on as in rather rapid walking, about mm120 to the beat. A curious strengthening of this impression is gained by the bass or heavier drum taking the quarter notes in alternate markedly heavy and light strokes. An effect very common in Jamaican drum-

ming, in addition to the sounding of notes on the second half of the beat in syncopation, is that produced by what I am tempted to call the syncopated measure, although real syncopation does not exist in that sense. This effect is obtained by playing notes of very small value in the first part of the measure, followed by those of larger value in the last part, thus throwing the weight of the notes at the end, in much the same way as a note half a beat in length at the beginning of a measure followed by one a whole beat in length throws weight on the last half of the first beat carrying over into the second beat. In the former case, however, the beats are not split by notes which hold over the points of beginning and ending, nor is the beginning of the new measure obscured by a holding over from the last, as is the case in beat syncopation, which is as common as is this false measure "syncopation."

The variety of rhythmic patterns of which Jamaican drummers are capable seems almost infinite, and while in the music to which I listened some patterns might be continued long enough to enable me to note them clearly, the rhythms shifted apparently without rule any number of times in the course of a tune as if the leader were guided solely by caprice. The triangle player was plainly not so versatile as his chief, whose shimmering rhythmic changes were woven around the regular beat of the heavy drum.

The flutist played various tunes known to the people as *sha-shas* (pronounced shay-shays), catch-me-times, mentos, reels, lanciers, two-steps, and others. Many of these dance tunes are presumably taken from Scottish airs or from old English dance music.

For two weeks one heard drum rhythms everywhere, and always expected to remember them and jot them down later, but they would soon be supplanted by others, and so forgotten. One rhythm which stands out in memory came from a remote meeting place in the brush when the thick, warm, pulsing blackness hid even the white road beneath our feet. Its joyous, bounding vigor is but poorly indicated by the notes.

The drums used in revival meetings and by the John Canoe companies at Christmas time deserve more than passing notice, especially the curious little drum that appears in the less sophisticated John Canoe companies. The drums when used at revivals have a different significance than when played for secular occasions to the accompaniment of *Jámal* songs, as the black people call the selections that are then sung. I believe they are also different in identity, though in design they are the customary side or snare and bass. Two of the former and one of the latter supply "plenty powah" as I learned on one occasion when attending a meeting. We were given seats of honor, mine being directly in front of the drummers, but strange to say, after the first few deafening moments when the vibrations threatened to sever my spine, I found the rhythms of the drums stealing over my senses to such an extent that all the blare was forgotten in the supreme electric effect they engendered. The whole dusky audience pressed closer and closer around the drummers in the smoky torchlight, singing with more and more abandon. Religious fervor mounted high and had it not been for faithful Morrison, our

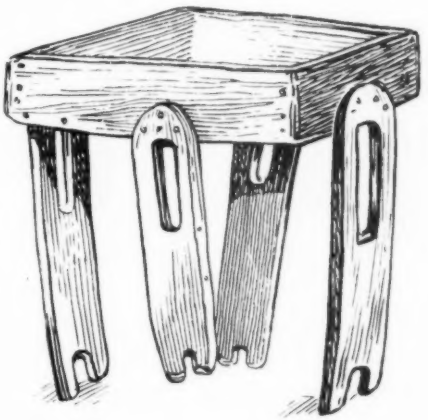
black guard, I should have feared to remain. We left the gathering before it had reached its highest state of exaltation, and although in that district at least, fanatical outbreaks, during which the more zealous cut themselves with knives and beat one another, are presumably unknown, they do occur in others. Although the rhythms employed in connection with church singing are, as a result of contact with the hymns, reduced in their syncopations to the minimum possible in the case of negro performers, syncopation is never totally absent.

We were able to see and hear three John Canoe companies,—composed of strolling singers and drummers and a triangle player at Lacovia, of drummers and singers at a still more remote place called Prospect, and of flutists and drummers at Brownstown, which is a community of some importance although far from the railroads.

The company at Lacovia in addition to a bass and side drum had a curious little instrument which they called the *gumbé* (pronounced gumbay). The people assert that all their equipment is destroyed each year after the season of festivities, and they parted with it, little temple and drums, without any apparent regret after bargaining for a considerable sum.[1] But while it may be true that the temple is made afresh each year, the drums are certainly preserved from season to season, for those purchased were quite old, the *gumbé* especially, as is evidenced by the fact that its originally thick goatskin membrane had been worn through in many places and patched. When it is realized that this instrument is played with the hands only, the wear is all the more indicative of age.

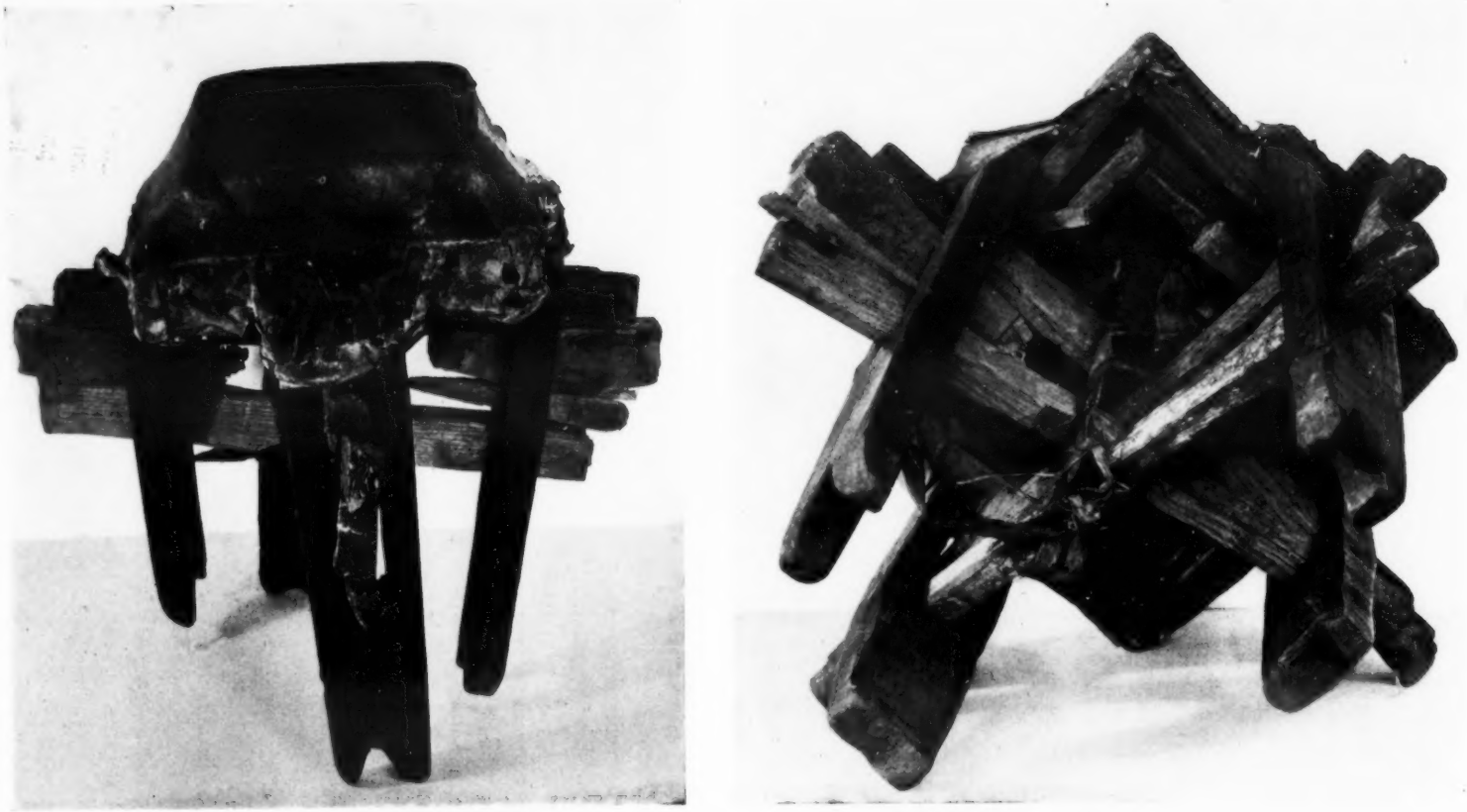
[1]The specimens are in the American Museum together with a fine old bamboo flute.

The *gumbé* is square and resembles a milking stool not a little except that it has four legs, two of which, forming opposites, are shorter than the other pair. While this disparity does not appear to be necessary and might seem the result of crude measuring, it was a noticeable feature of both the Lacovia and Prospect specimens, preventing the drum from standing unsupported. The player holds it slanting away from him as he crouches on his heels and thrums it with slaps of his broad palms near the base of the hand or with his fingers and broad splay thumbs, in almost unbelievably quick and complicated rhythms, which I found it quite impossible to take down in longhand and for the recording of which the phonograph was not available at Lacovia and at Prospect.



The framework of the *gumbé* before the goatskin has been stretched over the top and the inner square of wood inserted from below and pushed upward. Note the difference in the length of the two pairs of legs

The *gumbé* is African in general plan but the particular specimen which I examined was the crude product of more clumsy Jamaican handicraft. A brief description will be of interest.



THE DRUM KNOWN AS THE GUMBÉ, USED BY THE JAMAICAN NEGROES

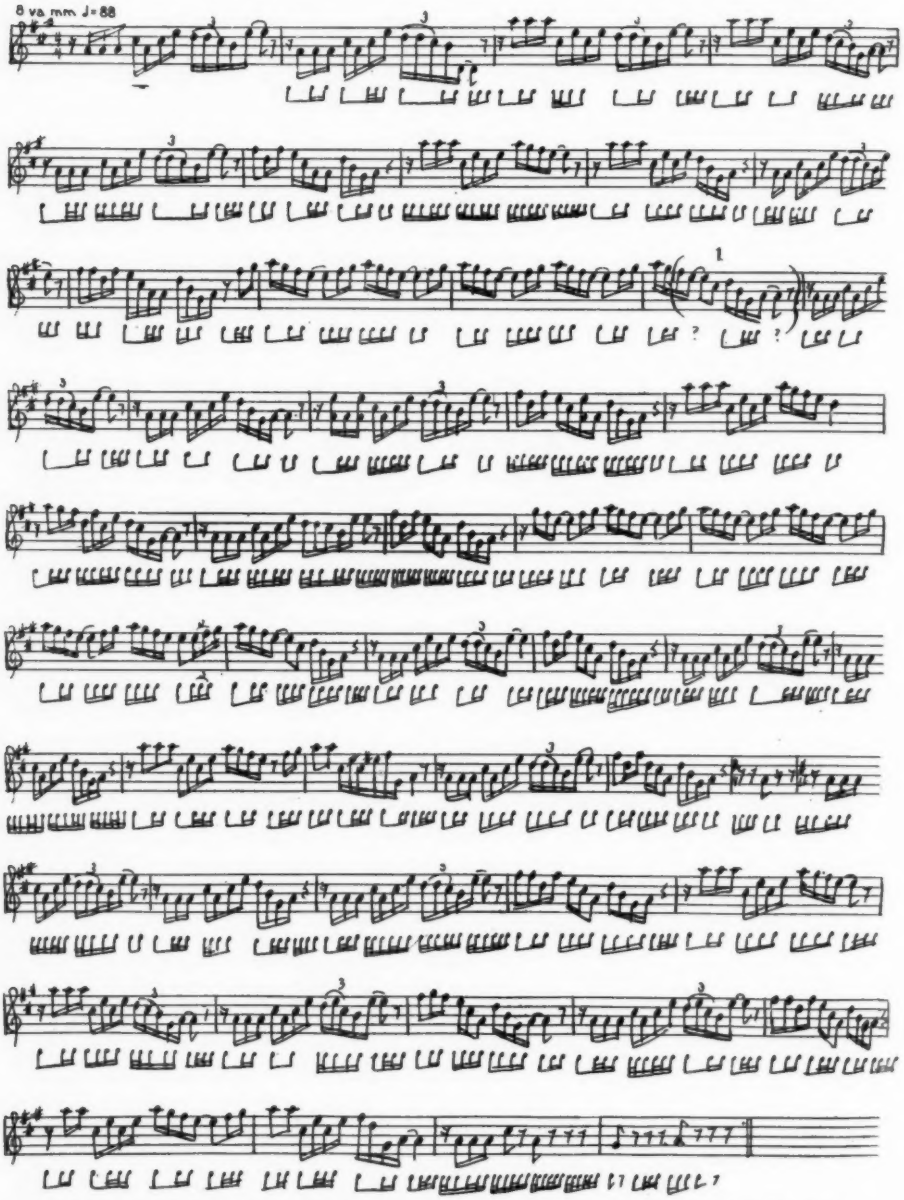
This drum, which somewhat resembles a milking stool, is played with the palms and fingers. In the picture on the right may be observed the inner wooden square which is fitted within the outer frame and forced upward, thereby tightening the goat skin covering and producing the pyramidal effect more clearly seen in the picture on the left

The fundamental frame is square, of boards about three inches wide fastened together at the ends. To the outer surface of this frame are nailed the four legs, placed not as one might suppose at the corners but at the middle of the sides of the frame, the two short legs being opposite. Into each leg for a portion of its length has been cut a broad slot; the top of each slot terminates on a line with the bottom edge of the board frame, which we might call the seat of the stool. Over this frame the goatskin has been stretched, and after being roughly shaped around the tops of the legs, has been nailed along the lower edge of the frame. Another frame which just fits within the first but the sides of which are wider, is slipped inside the first frame from underneath and pushed as far up against the skin as possible; but even after it has been forced upward its lower edge is considerably below that of the outer frame, due to the difference of width. Two cross slats, grooved slightly in the center where they cross so that they may not slip past each other, are run through the legs of the "stool" by means of the slots, and another pair is inserted in the same way, the distances between the pairs on all four sides being maintained by wedges driven into whatever intervening spaces may be left in the slots of the legs, thus keeping the inner frame of the seat as tightly pressed as possible against the goatskin. As the skin stretches with use and the wedges become loosened, others are inserted, either in their place or additionally, so that eventually the device has the appearance of being more complicated than it really is. Sometimes very small wedges are inserted between the edge of the inner frame and the first cross slat, instead of being added to the other wedges between the two sets of cross slats at the slots in the legs.

Considerable sound can be derived from the *gumbé*, especially on account of the force with which the negro slaps it, although there is no sound cavity of any size and what there is, is open toward the ground.

I have mentioned the fact that the *gumbé* is probably African in plan. There seems little doubt but that it is one of the survivals from the past. Maud Cuney Hare, writing of the drums of Africa, mentions a *gumbia* as being an instrument of Sierra Leone. This fact might not prove anything in itself, for some of the lawless Maroons of Jamaica who resisted capture and subjection by the British after the latter took the island from Spain, were eventually sent to Sierra Leone. I have examined Newland's *Sierra Leone* in vain for any mention of it, or for much about any of the music. It is known, however, that some of the tribes originally transported to Jamaica were from that part of West Africa where the so-called Tshi languages are spoken. Ellis in *The Tshi-Speaking Peoples of the Gold Coast of West Africa* refers on pp. 326–27 to finger-played drums and the language of drums. A. Werner, who wrote the introduction of Jekyll's *Jamaican Song and Story*, which compares Jamaican music and folklore with African, deals with the music at length in his own *Natives of British Central Africa*. He says on page 225 that Central African drums do not have more than one head, that some are played by hand and that there is a four-legged drum, like a small round stool, which is beaten with two sticks as it stands on the ground. Most of the better-known authors of large treatises on African life say little if anything about the music or mention it only in

R.71. John Canoe Music. Flute and Drum. Brownstown. Company from Orange Hill



(1) The notes enclosed by parentheses are reconstructed from a similar passage later in the song. There was a fault in the record covering the notes that have been replaced.

passing as being impressive. The article by Algernon Rose entitled "A Private Collection of African Instruments," published in the *Zeitschrift für die Internationale Musikgesellschaft*, Leipzig, 1904, pp. 60 ff., mentions no drum like the *gumbé*.

Finally, an examination of the Crosby-Brown collection of musical instruments from Africa, in the Met-o-

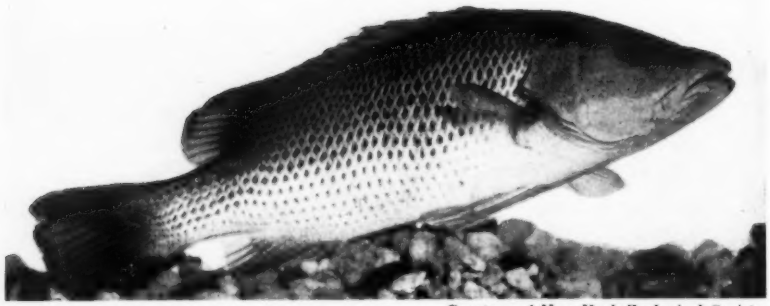
politan Museum of Art, reveals several, which if not like our Jamaican specimen, show where the idea for its leg structure originated, coming, as these museum specimens do, from the very part of Africa from which the Jamaican negroes were taken. One has for its base a wooden ring in one piece with two stubby pointed pegs which are stuck in the ground as the drum is played. Many drums have legs of some sort, but all are round and none has the inner frame and the slots and wedges.

The name *gumbé* is strangely like that of Senegambia and that of Gambia, respectively, a province and an island within the province, near the Gold Coast from which the Jamaican negroes came and from which the Metropolitan Museum of Art has specimens of drums with legs and but one vibrating surface.

The *gumbé* has no definite pitch but emits a sound like "thwank" in varying degrees of volume. As for the other drums of Jamaica it can hardly be said that they are pitched. Particularly does this apply to the side drums; some of the larger bass drums, on the other hand, have more musical tones. There is not, so far as I am aware, any attempt to tune the drums other than to keep the skins taut, and no conscious attempt to sing in tune with them, although I have noted that in revival meetings, when the singing has been going on for some time, the boom of the bass drums seems to influence the choice of a key so that its fundamental and the drum are in close accord.

I made a final effort to record on the phonograph the music of the John Canoe company of Brownstown, where there were drums and flutes but no *gumbé*, and this time indoors. One of these records was clear enough to transcribe although only one of the drums is audible. Subsequent experiments have shown me that the sounds of drums or other instruments of percussion below a certain pitch are not caught by the ordinary hand phonograph. The transcription of flute music with the rhythm of one of the drums is given on the opposing page.

The rhythmic pattern adopted by the drum will be apparent with a little study, and actual perusal of the notes will reveal the peculiarities better than a description. I have made no mention of the flute other than in passing, for enough flute music was collected, together with several instruments and data concerning them, to justify independent treatment. The present example is the only one where the combination of flute and drums was secured.



Courtesy of New York Zoological Society

Photograph, taken by Elwin R. Sanborn, of a gray snapper in the New York Aquarium

Notes on the Behavior of the Gray Snapper, a Common West Indian Fish

By E. W. GUDGER
Associate in Ichthyology, American Museum

THE Tortugas islets are the far-flung last of the Florida Keys. They form an archipelago of coral sand roughly surrounding a lagoon of comparatively shallow water, and are situated on the outer, or western, end of the great submarine plateau of Florida, seventy miles west of Key West. The westernmost of these islets is Loggerhead, so named because of the great number of turtles of that name that used to "haul out" on its sandy shores to lay their eggs. Loggerhead Key is a flat crescent with the concave side facing the west; it is about three-quarters of a mile long by one-quarter wide at the middle of the crescent. The Biological Laboratory of the Carnegie Institution of Washington is situated near the tip of the northern horn, and it was at this institution that the observations recorded in this article were made.

The gray snappers (*Neomænis griseus*) are so called because of their color. Another name applied to them is "mangrove snappers" because they lurk in the tangles of mangrove roots, probably to catch the crabs that crawl in and about these roots. They are among the most abundant of the fishes found about the Florida Keys, where they patrol the shores in schools. In this connection it is interesting to note that members of these bands are approximately of the same size and that the bands include no small specimens.

Being very abundant, going in schools, and patrolling the shores, they are of all fishes at the Tortugas perhaps the easiest to study. And of all that I have observed there, none seemed more interesting from the standpoint of their behavior. About two or three dozen used to "hang around" the western dock at Loggerhead, playing or seemingly resting under its shadow. Their chief purpose in remaining there was, however, to feed on scraps thrown overboard by the cook. The fish apparently knew this individual and manifested no fear of him whatever, for whenever he appeared carrying a bucket or pan, the gray snappers were

all eagerness, and as he raised this utensil, there was a grand rush and the scraps and the snappers arrived at the surface at the same time.

Let some one else, however, walk out on the dock (which was about eight feet above the water) and some of the snappers (generally those nearest) would turn slightly on one side, thus keeping a wary eye on the intruder. If now he stooped to pick up something, the snappers would move off, and if the object picked up was the grains (a pair of which was nearly always kept at the pier head), the more timid fish would depart for deeper water. The bolder, however, seemed to like the game and held their positions until the grains were thrown, when in a flash they were gone. None, so far as I can recall, were ever taken thus though our most expert strikers were continually practising on them. Some of the fish presently seemed to recognize that there was little danger and would hardly move six feet away when struck at.

Many were the attempts to take them with hooks, especially on the part of newcomers, to whom they were an ever-present temptation. For years these efforts were unsuccessful but at last, in the summer of 1915, our cook's assistant, a professional fisherman from Key West, was able now and then to hook one at night. On one occasion a number were taken by being surrounded with a seine, but when they were cooked and brought to the table there was a general outcry of condemnation, led by the man who had been working longest at the laboratory and who phrased it that these fish were our companions and playmates and that it was an outrage thus to take advantage of their friendliness.

Our favorite bathing place was at a sandy beach on the east side of the island directly in front of the station. Here a dock, which ran out into the water five or six feet deep to support the intake pipe for the pump, acted as a springboard for diving and as an observatory for watching the fish. Around this dock and in and around the reef of oölitic limestone, which extended from it roughly parallel with the shore, large numbers of fishes played, presently becoming quite tame. Among these fishes were probably a hundred gray snappers, which had collected seemingly to be sociable among themselves and toward us. When the other men had swum away, I used frequently to stand quietly on this ledge of rock, whereupon the gray snappers would swim all around me, playing with each other and seemingly with me, for they would often come within a foot, so close indeed that I momentarily expected them to nibble at my fingers and toes. Then, when I turned and swam toward shore, a band of them on either side would fearlessly accompany me into water that was no more than knee-deep. This happened not once but a score of times.

Gray snappers are fond of ghost crabs (*Ocypoda arenaria*), and used to catch them in the following fashion. It was our custom after supper to walk to one end or the other of the island. The best footing was afforded by the hard sand between high and low water marks. As we strolled along on land, the gray snappers would parallel our course in the water, and when, as not infrequently happened, ghost crabs, frightened by our approach, scuttled into the sea, there was a quick rush by the snappers and the crabs never came back. In this way the fish secured their suppers.

THE SCHOOLHOUSE OF THE WORLD

This spirited picture of representive animals of the past and of the present, not to mention various primitive races of man, all headed toward the American Museum as their goal, was prepared a year or more before his death by the late Erwin S. Cristman

"The Schoolhouse of the World"

By WILLIAM K. GREGORY
Curator of Comparative Anatomy, American Museum

THE interesting picture reproduced herewith was made by the late Erwin S. Christman, of the department of vertebrate palæontology, American Museum, in 1920. It was originally intended for a newspaper article regarding the Museum, but was not used and has never been published before.

The picture shows the Museum as a "schoolhouse of the world," toward which all sorts of strange animals and people are heading in lines that converge from various parts of the earth. In the sky one sees on the right a long line of flamingos, and on the left several of the largest flying reptiles (*Pteranodon*). In the distance a dog team is driving across the Arctic wastes toward the Museum, while Eskimos are pulling a walrus out on the shore. Near the center a long line of horses is dragging a section of the "big tree" (*Sequoia*), which a giant gorilla is pushing from the rear. At the left we see the huge dinosaurs of varied form, the gigantic *Brontosaurus* overtopping the rest. In the foreground a mammoth is being hunted by men of the Old Stone Age, while at the right a procession of African and other mammals is followed by the Haida canoe and its strange company of Northwest Coast Indians. The insect world is represented by some giant dragon flies and other forms, and herpetology is symbolized by the serpent. The department of invertebrates is represented only by the lowly starfishes, but the artist could not find room for everything, and the minerals also are neglected.

The picture as a whole is very characteristic of Mr. Christman's joyous outlook on life, and of his devotion to the Museum and its interests.

THE SCHOOLHOUSE OF THE WORLD
This spirited picture of representive animals of the past and of the present, not to mention various primitive races of man, all headed toward the American Museum as their goal, was prepared a year or more before his death by the late Erwin S. Christman

The Coming Five Years, 1924-28, of the Third Asiatic Expedition

By ROY CHAPMAN ANDREWS

IN September 1923, President Henry Fairfield Osborn inspected the personnel and management of the Third Asiatic Expedition and visited some of the most important fossil deposits in east-central Mongolia. He agreed with the leader and the entire scientific staff that its work could not be completed in the two years which remained of the five-year period, 1921–25, originally planned for the expedition. In every branch of science the results were so gratifying and so profoundly important that it was obvious that at the termination of the original period of five years the work should be continued for an additional three years.

Moreover, the vast collections and the wealth of new scientific data which had been obtained made it highly desirable to bring all the members of the scientific staff to New York where there could be an assembling of the results, with a view to their publication, and where a new perspective of the future work might be gained from what already had been done. The entire staff is now at work in New York and a large part of the collections have reached the American Museum in safety.

Nineteen preliminary papers have appeared in the Museum publications. A series, to be entitled *Mongolia*, is projected and will include the complete scientific results of the expedition in twelve volumes. A certain sum will be set aside each year so that publication may be carried on coincident with the field investigations and the results thus given to the public as rapidly as possible. It is my intention to write a popular account, in two or three volumes, of the general field work and the results attained.

In order that we might plan intelligently for the next five years' work it was necessary to have the funds assured in advance. In the belief that the members and friends of the American Museum would be glad to assist financially if it were brought to their attention, I addressed them a letter which is meeting with a most gratifying response. Already $17,500 has been obtained through this letter alone and pledges are still being received.

To carry out our plans it is necessary to have $50,000 a year. As this issue of NATURAL HISTORY goes to press, a sum equivalent to $40,000 annually has been subscribed, and only $10,000 a year remains to be obtained. I want to take this opportunity to express my personal appreciation of the interest in the expedition which the members of the American Museum have shown. I speak for the entire staff of the Third Asiatic Expedition when I say that we shall do our utmost to carry on the work with the same enthusiasm with which it has been begun.

I shall sail for China on June 10 on the Pacific Mail S.S. "President Cleveland," and shall reach Peking about July 4. Almost immediately I shall have to go to Urga to conclude the diplomatic arrangements for the next summer's work. Then the vast quantity of supplies and equipment must be assembled and packed, for the caravan must start its long march across the desert by January 1 if it is to reach its destination by the time I arrive by automobile in April. The other members of the staff will leave New York for China in February, 1925.

We shall begin work at Chagan Nor, nearly a thousand miles from Kalgan, where we left off at the end of last year. This means that the organization and preparation of the expedition must be more carefully considered than in the past when investigations started almost at the door of Kalgan.

In 1922–23 we worked extensively in strata of the Age of Reptiles and the early part of the Age of Mammals. We plan now to give especial attention to the last part of the Age of Mammals, and to add to the scope of the expedition other branches of science: archaeology, anthropology, botany, and ornithology. What the future has in store for us no one can say, but we shall go forth with enthusiasm and high hope to meet the next great adventure.

The names of those who are making possible the continuation of the work of the Third Asiatic Expedition during the coming five years (1924-28) are listed on the opposing page.

The country-wide support that has been

given the expedition is indicated by the fact that the contributors represented no less than twenty-three states, and even from distant Porto Rico a contribution was sent. In addition to the district of Columbia, residents in the following states contributed to the fund that will make possible the continuation of the work of the expedition: Arizona, California, Colorado, Connecticut, Georgia, Illinois, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Vermont, West Virginia, Wisconsin.

List of Contributors

Mr. Fritz Achelis, American Asiatic Association and Asia, American Museum, Mrs. John Storm Appleby, Mr. E. J. Armstrong, Miss Carrie Ethel Baker, Mr. George F. Baker, Mr. George J. Baldwin, Mr. Louis Bamberger, Mr. John Edwards Barbour, Mr. James H. Barr, Mr. George D. Barron, Mrs. F. O. Barton, Mrs. Daniel Beckwith, Mr. William F. Beller, Mr. Henry J. Bernheim, Mr. and Mrs. Charles L. Bernheimer, Mr. Edward Lyman Bill, Mr. James L. Blackmer, Miss Elizabeth B. Bliss, Mr. Charles C. Bolton, Mr. George T. Brokaw, Dr. Henry Brodman, Mr. Gabriel Cannon, Hon. George A. Carden, Mr. C. L. Carpenter, Mr. Edward Pearce Casey, Mr. George Agnew Chamberlain, Mr. W. F. Chandler, Miss Cornelia Van A. Chapin, Miss Mary Cheney, Mr. Paul H. Cheney, Mr. Percy Chubb, Mr. E. D. Church, Miss Ella Mabel Clark, Miss Louise H. Colburn, Mr. Harry N. Cole, Mr. Russell Colgate, Mr. Sidney M. Colgate, Mr. Walter B. Congdon, Dr. Henry H. Covell, Miss Louise G. Crabbe, Mr. Henry M. Crane, Rev. W. T. Crocker, Mr. Albert H. Crosby, Mr. J. S. Cullinan, Mr. Franklin Curtiss, Miss Mary O'Hara Darlington, Mr. Waters S. Davis, Mr. Henry P. Davison, Mrs. Elizabeth B. Davenport, Mr. Richard H. Day, Miss Pauline H. Dederer, Mr. William P. Deppe, Dr. Charles A. Dewey, Miss Ethel Du Bois, Mr. F. L. Dunbar, Mr. Kimball G. Easton, Miss Elizabeth S. Edwards, Mr. H. A. Elsberg, Mrs. Edward W. Emerson, Miss Julia T. Emerson, Mr. R. Erbsloh, Mr. Thomas G. Farrell, Mr. P I. Farrington, Miss Eleanor Ferguson, Mr. George L. Fordyce, Mr. Theo. Foulk, Mr. Noel Bleecker Fox, Mrs. Cyril Francklyn, Mr. George C. Fraser, Mr. Childs Frick, Mr. A. S. Frissell, Mr. William E. Fulton, Prof. Simon H. Gage, Mrs. Charles W. Gale, Hon. John W. Garrett, Mrs. Frederick M. Gilbert, Mr. Robert J. Goodenough, Mrs. George A. Goss, Mr. Joseph C. Grew, Mrs. Edward A. Grossmann, Mr. Harry Peale Haldt, Mr. Harold V. W. Halsey, Mr. N. A. Hardee, Mr. E. Roland Harriman, Mr. William Averell Harriman, Mr. Hancke Hencken, Mr. Walter Hidden, Mrs. Annie L. Hoe, Rev. George G. Hollingshead, D.D., Mr. Charles L. Holmes, Mr. Walter W. Holmes, Hon. George C. Holt, Mr. Clement S. Houghton, Mr. Roland Jackson Hunter, Mr. Franklin C. Irish, Prof. Henry S. Jacoby, Mr. Arthur Curtiss James, Mrs. Adrian Hoffman Joline, Mr. Philip Kachurin, Dr. W. W. Keen, Dr. J. H. Kellogg, Mr. Walter Schuyler Kemeys, Mr. William M. Kern, Mr. Darwin P. Kingsley, Dr. William B. Kirkham, Mr. Alexander H. Kridel, Hon. E. Henry Lacombe, Mr. T. W. Lamont, Mr. Francis G. Landon, Mr. Clarence A. Ludlum, Mr. Arthur J. Mack, Mr. Charles E. Manierre, Mr. Geo. E. Marsh, Mr. John G. Masson, Mr. Wallace E. Meyers, Mr. Hoyt Miller, Mr. Arthur N. Milliken, Dr. Adolph Monac-Lesser, Mrs. Benjamin Moore, Miss K. T. Moore, Mr. J. P. Morgan, Mr. Dwight W. Morrow, Mrs. Jay C. Morse, Mr. Philip A. Mosman, Mrs. John B. Mott, Mr. Gilbert S. McClintock, Mr. W. S. McCrea, Dr. Arthur B. McGraw, Mr. C. F. MacMurray, Mr. Charles H. Nettleton, Mr. Arthur E. Newbold, Jr., Mr. George Notman, Mrs. John C. Olmsted, Mr. George J. Openhym, Prof. Henry Fairfield Osborn, Mr. Arthur A. Osborne, Mr. Geo. E. Osterhout, Rev. Endicott Peabody, Dr. James Pedersen, Dr. Arnold Peskind, Mrs. Armistead Peter, 3rd, Mr. Armistead Peter, 3rd, Miss Isabel M. Peters, Miss Julia J. Pierrepont, Miss Katherine Pomeroy, Mr. Abram S. Post, Miss Margarethe Watson Potter, Mr. and Mrs. John T. Pratt, Mr. Edward Prizer, Mr. Ralph Pulitzer, Dr. Helen C. Putnam, Mr. Samuel Raisler, Mr. W. E. Ramsey, Mr. H. G. Ramsperger, Dr. R. O. Raymond, Mr. Arnold F. Riegger, Mr. Chandler Robbins, Mrs. C. L. F. Robinson, Mr. John D. Rockefeller, Jr., Mr. Saul E. Rogers, Mr. Max L. Rosenberg, Mrs. E. L. Rosensohn, Mrs. Arthur Ryerson, Mr. Homer E. Sargent, Mrs. Herbert L. Satterlee, Mr. Ewald H. Schniewind, Mr. Howard A. Scholle, Miss Emily E. Schwarz, Mr. Archibald T. Scofield, Mrs. James A. Scrymser, Mr. George St. John Sheffield, Mr. C. Sidney Shepard, Miss Mary A. Skeel, Mrs. Roswell Skeel, Jr., Mr. Albert Ernest Smith, Mr. F. Drexel Smith, Miss Harriet Otis Smith, Mr. W. Hinckle Smith, Mr. Francis Arnold Snell, Mr. Ekko Sollmann, Mr. Howard W. Starr, Dr. Colin C. Stewart, Mrs. Hugh Grant Straus, Mr. Arthur Hays Sulzberger, Mrs. J. Andrews Swan, Mr. Henry N. Sweet, Dr. Carl G. Swenson, Miss Mary Taber, Mr. Frederick M. P. Taylor, Mr. George F. Titus, Mr. A. W. Thompson, Mrs. J. Todhunter Thompson, Mr. S. B. Thorne, Mr. Carl J. Ulmann, The Veltin School, Mr. Fred Vogel, Jr., Mr. George Voigtlander, Mr. Hugo Weigert, Miss Amy Ogden Welcher, Rev. W. D. Westervelt, Dr. William B. Wherry, Rev. and Mrs. Eliot White, Mr. Ralston White, Mr. Harold O. Whitnall, Mrs. Eli Whitney, Mrs. Delos O. Wickham, Mr. Albert H. Wiggin, Mr. James B. Wilbur, Mr. Frank C. Willard, Mr. Ellis D. Williams, Mr. William Williams, Dr. Charles K. Winne, Jr., Dr. Lemuel Fox Woodward, Mrs. Eva Edgar Wright, Miss Jessie Ziegler, Miss Elsie Ahrens Zinsmeister.

"A Mother's Letters to a Schoolmaster"—A Review[1]

A penetrating book on the education of children has appeared under the title, *A Mother's Letters to a Schoolmaster*, the introduction having been written by the author of *Mind in the Making*. Besides being thus earnestly vouched for by James Harvey Robinson, it has been enthusiastically endorsed by other men in the forefront of the educational field—among them G. Stanley Hall, Albion W. Small, Thomas E. Finegan, and John Dewey—and it fully merits the great praise bestowed upon it by these educators.

The book contains a severe criticism of most of our present-day system of education, with definite, practical plans for radically improving the situation. Fads and untried theories are not advocated, but simplified and fundamental things to do are pressed for consideration. The author has that thorough knowledge of child psychology that enables one to express psychological truths in plain language. In this respect her presentation suggests that of Huxley in his biological lectures to working men. Not only is it clear and sound, it is intensely interesting.

The function of museums as educational institutions is appreciated and they are given their proper place in a modern scheme of education, correlating with the idea that natural history should logically take the leadership in a curriculum for elementary schools.

In proposed curricula for children's community centers (which the author of the book would substitute for the traditional type of school) the museum is provided for as a definite adjunct to every one of the child's activities. A "chart of civilization" classifies these activities not after the traditional manner according to academic subjects, but under simple sociological terms readily understood by the child mind and calculated to lead children to an intelligent comprehension of the world they are living in. These terms are shelter, sustenance, clothing, barter, communication, transportation, government or behavior, recreation and the arts, information. It is claimed that children learning to think of knowledge in these terms rather than as "subjects" apart from life and its ordinary activities, will develop breadth, tolerance, and world-mindedness. In this connection it is suggested in the *Letters* that the museum can and should play a vital part, not only in contributing as it now does to the general and especial interests of men, women, and children, through the various aspects of natural science and natural history, but in establishing *special exhibits* in order to emphasize the developmental character of civilization and to create an intelligent interest in the familiar objects and ordinary processes of everyday life. In this connection the author says:

> If we are ever to take hold of education as enlightened beings, with a firm intention to use it definitely as a training-experience for thinking and for life, a generator of social enthusiasm, an uprooter of inherited prejudices, a stabilizer of social attitudes, we must first put the fund of our knowledges in simpler array. We must assimilate it to our best social ideals, to the immenser retrospect which modern historical research has given us, to the new outlook which modern scientific discoveries have disclosed.

A "finding-out" basis of learning, whereby children will "live while they learn, and learn as they are living," is especially pleaded for, and this includes the utilization of every agency that will feed their curiosity and inventiveness and develop their powers of observation and discrimination. The author proposes such "exhibits of man's thought in action" as can be supplied by the museum, the motion picture, and the children's theater, with whatever other agents of dynamic teaching will "effectively broaden, elevate, stimulate and stir the minds and hearts of children."

The following quotations indicate the appreciation of a teacher's spirit and function: "One finds out just what truths base his convictions when he attempts to explain them to a child." "Any one who really loves what she has to impart, who herself finds things *interesting through and through*, will always find ways of imparting which will make her work as inspiring and as individual as any other work of art."

Bernard Shaw's trenchant remark, "He who can, does; he who can not, teaches," does not apply to the one who realizes that teaching is a joyous mission. It has been said that great art invariably conveys a sense that the artist had a superb time over his work, and this is just as true in the art of teaching as in any other.—G. CLYDE FISHER.

[1] *A Mother's Letters to a Schoolmaster*, with an Introduction by James Harvey Robinson. Published by Alfred A. Knopf.

Galápagos: World's End—A Review[1]

Galápagos: World's End, the title of Mr. William Beebe's latest book, is well chosen, for this volcanic archipelago, sundered from the rest of the world by more than five hundred linear miles of ocean, has no material riches to attract the covetous, and those who have reached its shores have for the most part been shipwrecked voyagers, buccaneers, exiled revolutionaries, law-breakers, and scientists. More than a dozen scientific expeditions have visited the islands since Darwin's memorable voyage in the "Beagle" nearly a century ago, but none which in so brief a time has accomplished so much as the Harrison Williams Galápagos Expedition of 1923.

While Mr. Beebe's personality dominates the volume, the work is a composite production, affording an insight into the special talents of those who were associated with him in the undertaking. There are vivid pictures in color by Miss Isabel Cooper—superbly reproduced by the publishers—photographs of technical excellence by Mr. John Tee-Van, three chapters written buoyantly as well as informingly by Miss Ruth Rose, a chapter on game fishing by Mr. Robert G. McKay, and a preface by Prof. Henry Fairfield Osborn of the American Museum, who, though not a member of the expedition, is particularly well fitted to weigh its achievements because of his broad interest in zoölogical exploration.

Mr. Beebe is not a closet scientist; his laboratory is the world of out-of-doors. Through his work at Kartabo he has shown what an inexhaustible field for observation even a small patch of jungle affords for seeing eyes. Imagine, then, the bewildering wealth of interest offered by the sixty or more islands and islets of the Galápagos and the necessity for utilizing every precious second when one's total time for observation on land is limited to a hundred hours! Necessarily only a few of the islands could be studied in the time available, yet thanks to the impressions flashed back by Mr. Beebe's many-faceted mind, one gets a picture that years of less inspired study would fail to give. There are accounts of the volcanic clinker fields radiating heat; the cacti that like barbed wire entanglements protect the unpenetrated interior of islands like Indefatigable; the bizarre black sea lizards that in their rugged contour suggest animated blocks of lava; the seabirds that in numbers nest on the floor of the Daphne Crater; and the lone specimen of a giant tortoise that rewarded the search for a reptile at one time among the most abundant in the islands.

Like all of those who have visited the Galápagos, from Fray Tomás de Berlanga, Bishop of Panama, who drifted there in 1535, to the present, Mr. Beebe was impressed with the trustful unconcern of the native creatures in the presence of man. A young mocking bird picked a grain of wet sand from Mr. Beebe's shoe, a little flycatcher alighted on the lens of his Graflex while he was focusing the camera, a short-eared owl sought a perch on his helmet, and on another occasion as Mr. Beebe stood motionless, a *Tropidurus* lizard approached and snatched an ant from his shoe.

A brief passage regarding an octopus must suffice as an example of the author's incisive descriptions:

> Nothing animate is comparable to this sight. The bulging mass of the head or body or both, the round staring eyes, as perfect and expressive as those of a mammal, and the horrible absence of all other bodily parts which such an eyed creature should have,—nothing more but eight horrid, cup-covered, snaky tentacles, reaching out in front, splaying sideways, and pushing behind, while one or more always waved in the air in the direction of suspected danger, as if in some sort of infernal adieu.

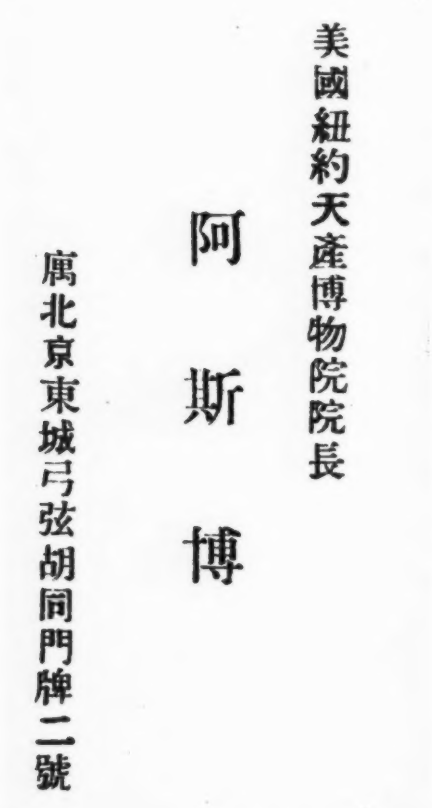
The scientific material gathered by the expedition is being worked up by numerous specialists. Among the 60 species of shore fishes brought back, 20 are new to the Galápagos and 2 are new to science; while, in the case of the insects, an hour's collecting at the head of Tagus Cove yielded 20 forms new to the islands and 10 not previously described. There is promise, therefore, that when the scientific reports make their appearance, they will list a substantial number of species hitherto unknown. But an equally important side of Mr. Beebe's work, well exemplified in *Galápagos: World's End*, is making more fully known the recognized forms of life in a region which because of its inaccessibility, few readers of the book will have an opportunity personally to visit.—H. F. Schwarz.

[1] *Galápagos: World's End* by William Beebe. With 24 colored illustrations by Isabel Cooper, and 83 photographs mostly by John Tee-Van. Published, under the auspices of the New York Zoological Society, by G. P. Putnam's Sons.

NOTES

ASIA

ADDRESSES BY PROF. HENRY FAIRFIELD OSBORN IN PEKING, SEPTEMBER 21 TO OCTOBER 11, 1923.—On his return from Mongolia to Peking, Professor Osborn was besieged by societies and institutions of all kinds in northern China for accounts of the Third Asiatic Expedition. It was agreed between Professor Osborn and Mr. Roy Chapman Andrews, leader of the expedition, that Professor Osborn should do all of the speaking in Peking and in other parts of northern China, while Mr. Andrews would become the spokesman as soon as a landing was made in America. This gave Professor Osborn an opportunity to make a series of highly appreciative addresses on the expedition. These began immediately after his arrival on the evening of Friday, September 21, and ended on Thursday, October 11, the evening before his departure.



The Chinese card of Prof. Henry Fairfield Osborn.—Ah Ssu-po, meaning "Man of wide learning," is the Chinese equivalent for the name Osborn, and the institution of which he is president is quaintly designated "The American Museum of Heavenly Creations"

The first Press conference was held on Sunday morning, September 23, in the headquarters of the American Museum, with a group of very talented newspaper correspondents, representing the Press of the English-speaking world. Among their number were Mr. David Fraser of the *London Times*, Colonel H. St. Clair Smallwood of the *London Daily Telegraph*, Mr. Grover Clark of the *Peking Leader*, Mr. Marshall of the *United Press*, Mr. Bab of the *Associated Press*, also representatives of the *Philadelphia Ledger*, the *Far Eastern News*, the *Shanghai Times*, and other periodicals. This interview lasted three hours and resulted in the dispatch of long, extremely accurate, and well written accounts to the leading London papers and the principal papers in northern China. This publicity gave the Third Asiatic Expedition the world-wide reputation it now enjoys. The cablegrams were prepared with the greatest care to avoid exaggeration, and those by David Fraser in the *London Times* and by Colonel Smallwood in the *London Daily Telegraph* were widely reproduced and syndicated both in the British and American Press.

On Monday morning, September 24, Professor Osborn and Mr. Andrews made their official call at the American legation, where they were most courteously received by the American Minister, Dr. Jacob Gould Schurman. It was there, through the kindness of the assistant Chinese secretary, Mr. Paul Joselyn, that Professor Osborn received his Chinese card, which is reproduced herewith. It proved impossible, even for Mr. Joselyn, who is thoroughly versed in Chinese, to translate literally either Professor Osborn's title or the name of the Museum. The interpretation of the card is as follows. The name Osborn in Chinese reads: Ah Ssu-po, signifying "Man of wide learning." The title reads: "President of the American Museum of Heavenly Creations." Professor Osborn was particularly delighted with the idea that the scope of the Museum's activities and its achievements had earned it the designation, "Museum of Heavenly Creations."

On the same evening, an official dinner to Professor and Mrs. Osborn and to Mr. and Mrs. Andrews was tendered by Minister Schurman at the American legation, representatives of the several foreign governments and leading Americans being invited. In the meantime active preparations were made for a series of public addresses.

As was eminently appropriate, the first scientific addresses were delivered before a large audience assembled in the building of the Geological Survey of the Republic, the meeting being held under the auspices of the Geological Society of China and presided over by Dr. V. K. Ting, honorary director of the Geological Survey. The opening address was made by Professor Osborn on the general scientific results achieved by the Third Asiatic Expedition, and was followed by briefer addresses by Mr. Roy Chapman Andrews, by Mr. Walter Granger on the palæontologic results of the expedition, and by Mr. Frederick K. Morris on the geologic and geographic results. On the evening of the same day, a memorable dinner was given by the Geological Society in honor of Professor Osborn and Mr. Andrews, the principal address being made by Doctor Ting. In clear and elegant English he paid a warm personal tribute to Professor Osborn and made glowing references to the work of the Third Asiatic Expedition.

On Friday evening, September 28, a personal dinner was given to Professor and Mrs. Osborn in the American Museum's headquarters by Mr. and Mrs. Andrews, to which were invited the principal members of the American and British colony. Within a large blue Mongol tent that was suspended from the ceiling of the dining room, were five tables, which seated the forty guests. The occasion happened to be the forty-second wedding anniversary of the principal guests of the evening, Professor and Mrs. Osborn, and the speeches and dinner cards were all of a delightfully humorous and sentimental character.

In the meantime the members of the American Association of North China arranged a luncheon, which was announced in the Press as follows:

> A large gathering of the American Association of North China is expected at the Grand Hotel des Wagons Lits for tiffin to-day when Dr. Henry Fairfield Osborn, the famous palæontologist and head of the American Museum of Natural Sciences of New York, which organized the Third Asiatic Expedition, will be the guest of honour. The members are requested to be at the Hotel promptly at twelve thirty.

The most prominent Americans in North China were gathered at this luncheon, as were also some of the British. Being called upon to speak, Professor Osborn chose as his subject "American Science in the Far East," briefly alluding to the rapid extension of exploration in various parts of Asia and the East Indies during the past twenty years by American explorers, geologists, and zoölogists.

On the morning of the same day, Professor Osborn gave an address to the students of the Chinese University of Peking, who were assembled in a large hall under the leadership of Chancellor Li, professor of geology, and Doctor A. W. Grabau, professor of palæontology. Chancellor Li made a beautiful address of introduction and Professor Osborn chose as his subject "Observations and Discoveries," pointing out the long and difficult pathway of preparation for exploration such as had made the Third Asiatic Expedition a brilliant success. This address included a warm acknowledgment of the inspiration that students of the University of Peking were receiving from the talented instructor, Doctor Grabau. A somewhat similar note was taken at the American Association tiffin, namely, that the Third Asiatic Expedition had really been forty-six years in preparation; that young American scientists, having conquered their own continent, were now going beyond into Asia, because "Westward the course of *science* takes its way."

Meanwhile Professor Osborn was preparing by far the most difficult of his series of addresses, namely, that for the Wan Yu Hui, or Friends of Literature. This group of men includes all the leading thinkers and writers in Peking, belonging to no less than thirteen different nations—Chinese, Japanese, Russians, Hungarians, Scandinavians, French, British, Germans, and Americans. For this distinguished and intellectual audience Professor Osborn prepared his most penetrating address, choosing to make a fresh prophecy as to the life of central Asia, under the title "Why Mongolia May Be the Home of the Human Race." In the course of this address, he tried to show that the palæontologic discoveries already made revealed the Mongolian plateau as a savanna country, partly forested, partly open, highly favorable to the most intelligent and resourceful primates of the kind which led to our human ancestors.

A popularized presentation of this same subject under the title "The Prehistory of Man and the Original Home of the Human Race" was set forth the following evening in the Peking Y. M. C. A. building, on the invitation of Mr. Robert Gailey, head of the Princeton-in-Peking movement. The audience was almost purely Chinese and it was necessary to have an interpreter, who repeated sentence by sentence Professor Osborn's address; the meaning was skillfully translated into beautiful and eloquent Chinese and the translator was frequently interrupted with outbursts of applause. The young Chinese listened with the closest attention to this first exposition to them of the principles of evolution as applied to the ancestry of man.

The address before the Wan Yu Hui was published in full in the *Peking Leader* by Grover Clark and was reproduced widely in the press of North China. It will be published in modified form in the not distant future. Professor Osborn wrote for the *China Journal of Science and Arts* another article entitled "Significance of Recent Discoveries in Mongolia." This journal is under the editorship of Mr. Arthur De Carle Sowerby and of Dr. John C. Ferguson, an eminent Sinologist.

On the subject of "Evolution and Religion," Professor Osborn addressed the students of the University of Peking as well as the students of the Woman's College in Peking—a most intelligent and responsive audience. The former institution represents a union of American schools and colleges in North China, starting originally with the educational work of the missionaries. It attracts a very superior class of young Chinese, both men and women. Professor Osborn again chose for his subject "Modern Aspects of the Evolution Question," touching upon the question raised by the fundamentalists at the present time in America.

On Wednesday, October 10, a second luncheon was given at the Wagons Lits Hotel by the Anglo-American Association, another distinguished audience drawn principally from the legations and leading professional and business men of Peking. Professor Osborn chose for his subject "British and American Science in the Far East." He cited many cases of the manner in which Americans and Britishers had worked side by side in various parts of the eastern world, especially of Lord Cromer's aid to his own expedition in the Fayûm in 1907, inspired by a letter from President Theodore Roosevelt. He referred to the coöperation of the British government in India with the two American Museum expeditions there—the Faunthorpe-Vernay Expedition and the Siwalik Hills Indian Expedition under Barnum Brown. He also spoke of the cordial spirit of helpfulness shown to the American Museum parties working in Australia.

Professor Osborn's final address was given on the evening of Thursday, October 11, before a very large and distinguished audience in the beautiful hall of social welfare of the Peking Union Medical College, erected by the Rockefeller Foundation. The speaker was introduced by Dr. Howard Houghton, director of the Peking University Medical College, and spoke on "Recent Discoveries in Mongolia." In the course of this lecture Professor Osborn showed a series of slides illustrating the work in the field. The audience crowded the large hall and even stood in the aisles listening, with occasional outbursts of enthusiastic applause, to the narrative of the second and third seasons of the Third Asiatic Expedition. Doctor Houghton described the results of the expedition as "thrilling," and it may be said without exaggeration that the thrill which the Museum's representatives felt because of the splendid recognition given in North China to the expedition's discoveries and the cordial welcome accorded to Professor Osborn, to Mr. Andrews, and to all the members of his party, helped to start them on their homeward journey to America with bright anticipations of a no less cordial welcome at home.

MAMMALS COLLECTED BY THE MUSEUM'S ASIATIC EXPEDITIONS.—In the course of the expeditions conducted by Mr. Roy C. Andrews, collections of mammals have been made that prove to be particularly rich in new forms. Already 21 of the mammals have been described as new to science; 9 of them are bats[1] and 12 insectivores.[2]

In the bat collection, which, by the way, is the largest ever made by any one expedition in China, an unusual opportunity is afforded for comparison of wide-ranging forms. This comprehensiveness is due to the fact that Mr. Andrews and his party have industriously worked the coastal lowlands as well as the

[1] "New Chinese Bats." By Glover M. Allen. 1923, Amer. Mus. *Novitates*, No. 85, pp. 1–8.

[2] "New Chinese Insectivores." By Glover M. Allen, 1923, Amer. Mus. *Novitates*, No. 100, pp. 1–11.

uplands of the interior. Some of the bats were even gathered in Chinese temples.

The series of insectivores contains an especially good representation of rare and interesting types from the Palæarctic as well as from the Indo-Malayan region. These results give a fair idea of the consummate skill of the naturalists in the field, for such animals too often are overlooked, chiefly on account of their small size and elusive ways, most of them being nocturnal or subterranean. Of great scientific interest are the representatives of the genera *Neotetracus*, *Hylomys*, *Scapanulus*, and *Scaptonyx*, and among the Menotyphla the fine series of the squirrel-like *Tupaia chinensis*. *Neotetracus sinensis*, known from only a few specimens, is a small, soft-haired, highland hedgehog with a long slender tail, and resembles in general size and color our common meadow mouse (*Microtus pennsylvanicus*). It was discovered as recently as 1909. *Hylomys peguensis* is another scarce member of the hedgehog family Erinaceidæ. Originally this genus was discovered in the Indian Archipelago, in Sumatra and Java. Its northern distribution in the Chinese highlands furnishes to zoölogists added proof of the probable derivation of the more southern fauna. *Hylomys*, though a short-tailed form, otherwise resembles its close ally *Neotetracus*. Also noteworthy for its rarity is the specimen of *Scapanulus oweni* from Tai-pei-shan, Shensi, the second to be recorded, and of *Scaptonyx fuscicaudatus affinis* from To-mu-lang, Chungtien, the third specimen thus far found. Furthermore, *Scaptonyx* is of more than ordinary scientific interest as it belongs to the Urotrichine series of genera which, with *Uropsilus*, forms the connecting link between the families Soricidæ (shrews) and Talpidæ (moles). Both the *Scapanulus* and *Scaptonyx*, which are included among the moles, were taken in the mountains at an altitude of 10,000 feet.

Dr. Glover M. Allen, of the Museum of Comparative Zoology at Cambridge, Massachusetts, who undertook the working out of this part of the scientific results of the Museum's Asiatic expeditions, has a number of other groups under examination. His preliminary reports on new species are very encouraging.—H. L.

Ancient Eggs.—A spirited editorial that has recently appeared in the London *Times* may be quoted as showing the lively interest that the discovery of the dinosaur eggs has occasioned:

It is some time since curiosity was first piqued, and fancy was stimulated, by the announcement that dinosaur eggs, estimated to be something like ten million years old, had been found fossilized in the Gobi Desert. There has been no underrating of the rare scientific value and importance of the discovery. But it has also, what all things scientifically valuable and important have not, its lighter side, for which a nation in the throes of an election campaign may be duly grateful. The misguided may, indeed, see design, or a strange fatality, in the fact that the discovered relics are now made visible, at any rate on paper, to the people of this country in the midst of their electioneering. The facile humorist will not be restrained from alluding to the traditional connexion between elections and eggs of uncertain age, or the serious-minded from administering to him the rebuke that dinosaur eggs are at once too precious and too hard for his nefarious purpose. If anything more is wanted to complete the jester's discomfiture, doubt may be expressed whether even eggs of a less exaggerated age any longer figure in the armoury of electoral argument, unless as a quaint survival at the election of Lord Rectors; and whether their place has not been taken by the verbal or oratorical egg, surpassing its material prototype in antiquity and yielding little to it in offensiveness, but, unlike it, possessing a resiliency which makes it capable of repeated use.

But the dinosaur eggs have no merely electoral flavour. They also revive, in a new, and therefore attractive, form, the old question, beloved of the schoolmen, whether the hen came before the egg, or the egg before the hen. It is reported that one item of the Mongolian discovery is an egg containing the embryo of an unborn dinosaur. The spirits of the metaphysical advocates of the egg rise in triumph at the news. But the uncompromising upholders of the hen are quick to retort that the complete skeleton of a mature dinosaur was found hard by, and the problem remains to vex us. The interest of the discovery appeals, however, far beyond the world of scientists, electors, and philosophers. It touches children, and many of those who once were children. Few of them will be able to think of the unborn baby dinosaur without conjuring up the picture of that friend of childhood, the missionary who

"... sits him down
To breakfast by the Nile."

Though

"His heart beneath his priestly gown
Is innocent of guile,"

it will be remembered that his saintliness is no defence against the stern decrees of Nature. And so it comes that presently he is seen no longer pursuing a comfortable meal, but scouring "the sandy Libyan plain."

"As one who runs to catch a train,
"Or wrestles with internal pain,

"Because he finds his egg contain,
"Green, hungry, horrible, and plain,
"A baby crocodile."

The connexion between the clerical profession and the ancient egg is indeed so lost in the mists of antiquity that a daring thinker might venture to speculate whether the skeleton of a curate may not yet be unearthed in Mongolia.

HONORARY MEMBERSHIP IN GEOLOGICAL SOCIETY OF CHINA.—Honorary Curator Osborn has recently received the following communication from Peking:

The Geological Society of China
9, Ping Ma Ssŭ
W. Peking, China.
January 15, 1924.

Professor Henry Fairfield Osborn, American Museum of Natural History, New York, U. S. A.

Dear Sir:

We have the honor to inform you that you were unanimously elected the first honorary member of Geological Society of China as an appreciation of the great work you have done to further Chinese Geology and Palæontology. We hope to receive your formal acceptance and shall send the Bulletin of the Society to you regularly.

Respectfully,
WONG WENHAO, *President.*
Y. C. SUN, *Secretary.*

Professor Osborn has formally accepted this honor in the following letter:

The American Museum of Natural History,
New York.
February 25, 1924.

My dear Sirs:

It is indeed a very great pleasure to learn by your letter of January fifteenth that I have been unanimously elected the first honorary member of the Geological Society of China. I assure you that this is one of the greatest pleasures of my scientific life, and is a very great encouragement for my future research. I am deeply interested in the work which is being done by the Geological Society of China and shall hereafter do my utmost to aid in every way, especially through the coöperation of my colleagues in the Third Asiatic Expedition of the American Museum.

I shall look forward to receiving the Bulletin of the Society with great interest.

In the meantime, I remain
Cordially and respectfully yours,
HENRY FAIRFIELD OSBORN, *President.*

SMITHSONIAN COLLECTIONS IN CHINA.—Representatives of the Smithsonian Institution have been busy for the past year or so in China making biological collections. In the summer of 1921, Mr. Arthur de C. Sowerby, who had been away from China in connection with the War in Europe since the end of 1917, returned to that country to continue his biological work. Ever since the Clark Expedition in western China, in 1908–09, Mr. Sowerby had been exploring in China, Mongolia, and Manchuria, making extensive biological collections. These were presented to the Smithsonian Institution by the gentleman who financed the collector.

Mr. Sowerby returned to China with a view to exploring the central and southern provinces so as to complete his survey of the country and round out the biological collections.

After making a collection of marine animals at Pei-tai-ho on the northern coast of Chihli Province, Mr. Sowerby established his headquarters at Shanghai, whence he visited Fukien Province in the winter of 1921–22, again in the late spring and early summer of 1922, and once more in the summer of 1923, making very extensive collections of birds, beasts, reptiles, fishes, and invertebrates.

Owing, however, to subsequent political disturbances throughout south and central China, he was prevented from undertaking more extensive journeys, but contented himself in the meanwhile with making collections of birds and fish in the Yangtze Delta.

Early in 1923, the Smithsonian Institution sent Mr. Charles M. Hoy, well known for the fine collections of mammals he made in Australia, to China to carry on collecting work in the Yangtze Valley. This able young American spent a busy time in the late spring and summer in the Tungting Lake district, where in 1914 he discovered the remarkable cetacean popularly known as the "white flag" dolphin, and described by Mr. Gerrit Miller under the name *Lipotes vexillifer*. Late in the summer, Mr. Hoy was taken seriously ill, an operation being necessary. This proved fatal, and the Smithsonian Institution lost one of the most promising young field naturalists and collectors of the day.

MR. ARTHUR DE CARLE SOWERBY, F.R.G.S., editor of *The China Journal of Science and Arts*, has expressed his readiness to send to NATURAL HISTORY from time to time Notes of scientific interest concerned with China. We take pleasure in printing below certain paragraphs recently received from him regarding natural-history teaching in the Far East:

The teaching of natural history in China has always remained in the background of Western education for the simple reason that the Chinese have not been able to see its practical value. Foreign languages, mathematics and such sciences as chemistry, geology, and en-

gineering in all its branches, they have taken up with avidity; but zoölogy and botany—the study of living things—have been neglected.

Nevertheless, steadily during the past decade or so, those responsible for the education of Young China in the large colleges and universities, many of which have been founded by missionary societies, have introduced the study of natural history in all its branches into the curricula of their institutions, and today there are several such institutions where biology forms an important subject of tuition.

Notable among these are Amoy University, Fukien Christian University, Foochow, both in Fukien Province, and Shantung Christian University, Tsinan, Shantung. In the first of these, Professors S. F. Light and Chung are giving extensive instruction in zoölogy and botany respectively, while Prof. C. R. Kellogg is teaching zoölogy in Fukien Christian University, and Prof. A. P. Jacot in the Shantung Christian University.

St. John's University in Shanghai also provides splendid courses in biology, as do the Southeastern University at Nanking and the Union Medical School in Peking.

It is still uphill work, however, to make Chinese students realize the value of biology, and many of them take up the subject half-heartedly, and apparently only to fill in time. This is all the more remarkable, since the Chinese are essentially nature lovers, as witness their art, and are extremely fond of both animals and plants. But the cult of these is looked upon as a pastime and not as part of the serious business of life.

Another contribution from Mr. Sowerby deals with the proposed natural history museum in Shanghai. Regarding this he says:

For some time past, agitation has been taking place in Shanghai for the erection of a museum, art gallery, and reference library combined, but so far little support has been given it by those financially able to do so. Up to the present there have been only two museums in Shanghai: that of the Royal Asiatic Society (North China branch), situated in the heart of the International Settlement, and the Zikawei Museum, belonging to the Jesuit Mission, which is situated well outside the town. The former is seriously handicapped for lack of funds and accommodation, while the latter, being a working museum and not open to the public generally, does not fulfill the needs of the town for an institution to which everyone may have access. There is also a lamentable lack of good libraries in Shanghai while such a thing as an art gallery is non-existent. Considering the size to which Shanghai has grown, this is deplorable, and there are many who are working to bring about a change in the right direction. The need of such a museum and art gallery, not to mention the reference library, is very great, for there are a large number of people in China to whom such institutions would be of untold value.

The China Society.—At the eleventh annual dinner of the China Society of America the Third Asiatic Expedition was represented by President Osborn, who spoke on the general purposes of the work in China and Mongolia, and by Curator Roy Chapman Andrews, who gave a brief account of the expedition. Of the several observations Professor Osborn made during his journey in China, the most important is that China is in far more danger from the "White Peril" than America is or ever will be from the Yellow Peril. The bogy of united Japan and China with an army of countless millions sweeping like the ancient forces of Genghis Khan westward across Europe, destroying its civilization and finally engulfing the United States, is fading everywhere. In the opinion of Professor Osborn it is not now nor will it be at any future time to the interests of either China or Japan to form an aggressive military union. On the other hand, both China and Japan are seriously threatened with what may be called the "White Peril," namely, the absorption of certain of the finest of their cultural and æsthetic characteristics by the mechanical and commercial spirit of western Europe and of America. Very slowly American taste in dress, in house decoration, in the smaller articles of household furnishing, tends to invade and replace the impeccable taste of China and Japan, founded upon thousands of years of æsthetic development. More rapidly still American and British advertising methods are invading China, and some of the most picturesque buildings and walls are being covered with advertisements of oil and tobacco. The "White Peril" is also invading the ranks of labor and introducing new economic factors in the form of labor-saving machinery and factory life.

The Chinese are not caring for their religious monuments, their superb temples, gateways, triumphal and memorial arches, their statues and images, which, with some exceptions, are not being protected from the depredations of vandals or from the vicissitudes of the weather. A splendid opportunity for the Archæological Society of America is to establish active branches in more than one city of China and coöperate with the cultured and intellectual classes of China in the preservation of these marvelous monuments. These were some of the ideas which Professor Osborn conveyed in his brief address before the China Society.

THE LION OF INDIA.—In the issue of NATURAL HISTORY for September–October, 1923, Colonel J. C. Faunthorpe presented an interesting note on the "Vanishing Lion of India," stating that while it was once quite abundant in certain parts of India, it now occurs only in the Gir Forest, Kathiawar, Bombay Presidency.

Through the kindness of Lord Lamington the American Museum has obtained a specimen of the Indian lion taken by him, or by one of his party, in this very forest seventeen years ago, when he was Governor of Bombay. Lord Lamington writes that on this same day, Doctor Carnegie, Political Officer, was mauled and killed by a wounded lion.

The lion of India, as it is represented in the volume entitled *The Tower Menagerie*. The picture is based on a specimen that was an inmate of the Tower Menagerie about one hundred years ago

There are practically no examples of the Indian lion preserved in museums—certainly no really good specimen—this being one of the too numerous instances when a species has been exterminated, or reduced almost to the vanishing point, before it was realized that this point had been reached. The process of extermination was indeed rapid in some regions. For example, Major Brown, in 1837, writes that the lion which once "infested" the country about Hurriana (now Hansi) had become extinct south of the Cugar River. This he ascribes to the fact that "Having no secluded dens to retire to during the hot weather, the lions, from necessity, took up their abode where water could be found; and as places of this description were rare, and generally near villages, their retreat was easily beaten up and their entire destruction easily effected."

The specimen received from Lord Lamington is in the form of a rug, but fortunately one that has suffered little from use, so that should the Museum fail to secure a fresh skin, it is possible by modern methods of taxidermy to convert this rug into a mounted specimen—not so satisfactory as could be made from a recently killed animal, but one that fifty years ago would have been looked upon as a triumph of art.

Whether or not the lion of India is distinct from that of Africa is still a debatable question; so far as looks go, there seems to be little or no choice between them: "Perhaps the largest lion ever seen in England was one caught when very young in Hurriana by General Watson and presented to George IV. This was the 'King George' of the Tower collection. Its mane wassuperbly developed,"[1] as is shown in the illustration reproduced from a beautiful wood cut in the *Tower Menagerie*.—F. A. L.

MINERALS AND GEMS

A FREE COURSE OF SIX POPULAR ILLUSTRATED LECTURES on "Gems and Gem Minerals" is being delivered weekly, on Thursday evenings at 8:15, from February 28 to April 3 inclusive, by Mr. Herbert P. Whitlock, curator of minerals, American Museum, at lecture room 604, 32 Waverly Place, under the auspices of New York University. The subjects considered are "The Diamond and How It is Polished," "Precious Stones Other Than Diamonds," "Some Semi-precious Stones," "The Quartz Gems," "The Opaque Gem Stones," "The Art of the Lapidary."

LONG ISLAND BIOLOGICAL ASSOCIATION

A meeting of the Board of Managers of the Long Island Biological Association was held on February 29, under the chairmanship of Colonel T. S. Williams. Dr. G. Clyde Fisher represents the American Museum on the Board and reports that at the meeting by-laws were formulated, officers elected, and a budget adopted. The appointment of Mr. Reginald G. Harris as director of the biological laboratory of the association was confirmed.

THE MARSH DARIEN EXPEDITION

MR. R. O. MARSH has organized an expedition that will work along the Rio Chucunaque in the San Blas country of southwestern

[1]Quoted from *A Manual of Indian Sport*.

Panama. This region has never been explored scientifically and several white men who in recent years have attempted to penetrate it have not returned. Presumably they were killed by the hostile Indians living there, who resent intrusions into their country. The present expedition will be protected by a detail of soldiers and will undoubtedly secure results of great anthropologic and biologic interest. Representing the Smithsonian Institution on the expedition is the anthropologist Dr. John L. Baer, while Prof. H. L. Fairchild, of the University of Rochester, accompanies the expedition as geologist. The American Museum has been privileged to send as its representative, Mr. C. M. Breder, Jr., who will devote his efforts mainly to the collecting of amphibians, reptiles, and fishes, and to the gathering of life history data. The specimens secured in the course of his anticipated sojourn of three months will become the property of the Museum.

Mr. Breder's letters from the Canal Zone, written on the eve of the expedition's departure for the wilderness, indicate that his work has been well begun, for although seasonal conditions were unpromising for the collecting of frogs and it seemed probable that *Bufo marinus* would be the only amphibian found breeding in the Zone, he collected a large number of small frogs and some well advanced tadpoles "with what appears to be a vibratory tail tip," a peculiarity of the more graceful swimmers among the tadpoles. A semi-arboreal salamander (*Œdipus*) was also secured. Several geckos were shipped to the Museum alive and reached their destination in good condition. Enjoying, as a substitute for the tropical sun, the warmth that comes from the radiator near which they are placed, they bid fair to survive, the more so as they are showing a real relish for the fruit flies with which they are daily fed.

SCIENCE OF MAN

A Collection from the Cañon del Muerto, New Mexico.—One of the most remarkable collections of pre-pueblo material ever made in the Southwest is being assembled in the American Museum by Mr. Earl H. Morris, to whom is due the credit for the discovery of the site in the course of the Third Charles L. Bernheimer Expedition to the Southwest. This expedition was led and financed by Mr. Bernheimer. Later, Mr. Morris, on a regular Museum expedition, returned to the site and made careful excavations.

About seventy miles in an air line from Pueblo Bonito of archæological fame, existed this unsuspected treasure house of ancient things, which, by way of belying its designation Cañon del Muerto (Cañon of the Dead), conferred upon it to commemorate a massacre of Navajos by Mexicans early in the nineteenth century, has yielded data for the resurrection of a vanished period of history. For here, in an unusual condition of preservation, was the record not of a fragment or episode of the past but of a long succession of developmental stages that enables one to visualize how the pre-pueblo people evolved from the "Basket Maker" level to the "Black and White Ware" stage that stands at the very threshold of pueblo history. Sandals with beautiful woven color patterns are among the very oldest material collected. By way of contrast to such articles of apparel, is the box of a medicine man, from the tightly sealed interior of which were taken the feathers of various birds—as fresh and glossy as though they had been purchased but yesterday at a milliner's shop. To give more than a hint of the basketry, pottery, and textiles that compose this collection is premature before the material can be worked up, but it may be stated that among the most exquisite of the objects collected are two ornaments of wood with beautiful turquoise inlay, belonging to the "Basket Maker" period. Most interesting of all, however, is the instance of a turkey —to the Pueblo Indians and apparently to their forebears a bird of sacred significance— that had a broken leg carefully placed between splints to enable recovery. This, it is believed, is the first discovered instance of an attempt by the Indians to set the bone of an animal and, taken in connection with the examples of trepanned skulls from Peru, is a not unworthy indication of Indian surgery.

CAUSES OF EVOLUTION

Doctor Kammerer Explains His Experiments.—On January 7, Dr. Paul Kammerer, the well-known experimental zoölogist of the Biologische Versuchsanstalt, Vienna, was the guest of the Journal Club, in the Osborn Library, American Museum, and gave a very interesting resumé of his experiments of the last twenty years, which he interprets as demonstrating that characters acquired in the course of the lifetime of parents are trans-

mitted to their offspring. The types he used with illustrations and photographs were the following: *Salamandra maculosa, S. atra, Alytes obstetricans, Proteus anguinus, Ciona intestinalis.* The paper was followed by a discussion in which President Osborn, Doctors W. D. Matthew, R. W. Miner, G. K. Noble, and Mr. William Beebe, a guest on the occasion, took part. All the zoölogical departments in the Museum were represented in the meeting. The general impression created by Doctor Kammerer's address and personality was very favorable. Although few members of the Journal Club are convinced as to the conclusiveness of his interpretations, all were impressed with his sincerity and directness, with the beauty and precision of many of his experiments, and with his courtesy and moderation toward those zoölogists who have more or less violently opposed his theories and attacked his evidence.

CONSERVATION

THE "REPORT OF THE DIRECTOR OF THE NATIONAL PARK SERVICE" for 1923 is of interest not only for the survey it gives of the work of the year but as an index of the recent growth of public interest in the scenic splendors of our land. It is more than fifty years since the Yellowstone was created a national park; but for decades, only an insignificant fraction of our population visited the great aggregate of marvels represented by that region. Nearly twenty years went by before a second national park, the Sequoia, was set aside for the benefit of the nation, and approximately another decade elapsed before the third link in the national park system was forged through the establishment of Mount Rainier National Park. By the middle of 1916, the year when the National Park Service was created, the national parks had increased to 14 and the national monuments to 18. In the eight years that have since elapsed 5 additional national parks and no less than 10 additional national monuments have come under the administration of the Service. Although this is an impressive growth, it is the figures of attendance that are of particular interest as an indication of the success of the publicity work of the Service and of the reorganization of the tourist facilities in the parks that has taken place during the directorship of Mr. Stephen T. Mather. The number of individuals visiting the parks last year totaled 1,493,712 in contrast to an aggregate of 356,097 in 1916.

During 1923 four new national monuments have been established: the Fossil Cycad National Monument in South Dakota, the Aztec Ruin National Monument in New Mexico (generously donated to the government by Mr. Archer M. Huntington of the Board of Trustees of the American Museum), the Hovenweep National Monument, Utah-Colorado, and the Pipe Spring National Monument in Arizona.

The setting aside as national parks of areas of commanding interest has been of such immeasurable educational, recreational, and inspirational value that it is eminently desirable that the park system be extended to include those spots of outstanding scenic or scientific significance that are still independent of that system. Among places of this type that Director Mather has at this time in mind are the Mammoth Cave area in Kentucky, the territory in New Mexico included in the so-called Bandelier National Monument, the Bryce Cañon region in Utah, already proposed as the Utah National Park, areas along the Great Lakes showing typical sections of inland lake and dunes, the redwood section of upper and central California, a typical portion of the Appalachian Mountains in the East, an example of the Everglades of Florida, or of the forested lands and hills of the South.

One notes with pleasure that during the year there was an increase among all the species in the Yellowstone National Park, especially marked in the case of the elk, pronghorn, and deer. By way of offset to this feeling of satisfaction is the indication that there has been a wanton disregard of the limitations under which hunting was now and then to be permitted in Mount McKinley National Park, in Alaska. As one of the principal objects in establishing this park was to accord a degree of protection to its vast herds of caribou, mountain sheep, and other game, the killing of large numbers of these animals by visiting prospectors calls for an adequate patrol service that will be possible only if the present annual appropriation of $8000 granted for the park is increased.

Museums exhibiting local specimens are an important factor in the educational program of the Service. During the past season the museum established in the Yosemite proved an attraction to 55,811 individuals. In the Mesa Verde National Park a museum building is under construction to house objects

found in the ruins of that area. The museum in the Yellowstone is outgrowing its present quarters and it is hoped that the old barracks may be available for its purposes. In the Casa Grande National Monument a small museum has been constructed during the past year, and is being filled little by little with pertinent exhibition material. The nature guide service offered in some of the parks has been of great value to those who want to know more about the natural forces that have been or are still operative in the several areas, or about the wild creatures that make these areas their habitat.

THE GAME BIRDS OF THE UNITED STATES.—The title, "Can We Save the Mammals?" selected by Prof. Henry Fairfield Osborn for the article which he prepared, with the collaboration of Mr. H. E. Anthony, and published in NATURAL HISTORY for September–October, 1922, is paralleled in the heading, "Can We Save Our Game Birds?" which Mr. T. Gilbert Pearson, president of the National Association of Audubon Societies, has chosen for his contribution to *The World's Work*, November, 1923. The similarity of the wording of these titles serves to emphasize the common danger to which the mammals and the game birds of our country are exposed. The wild turkey, once so characteristic of America that it might fittingly have served as our national emblem instead of the eagle, is today found in only a few out-of-the-way places; the heath hen, formerly an important source of food supply, is dwindling in numbers in its last place of refuge, Martha's Vineyard; the partridge is being persistently hunted and the reduction of its numbers to a dangerous level is rapidly being brought about; even the quail, exempt from persecution in some states on the ground that it is a songster—and who that has heard the cheery call "bob-white" in some meadow, could fail to love the bird that utters it?—is still hunted in others. The draining of our swamp lands has deprived the ducks and geese of breeding places but, due to the fact that the summer home of most of them is in the north, they have escaped the ravages to which they would have been subjected in more settled areas.

What is the solution? Can we indeed save our game birds? Over large areas in Europe, Mr. Pearson points out, the land is more densely populated than in America, yet upland game birds are in relatively greater abundance. There the land owner does not permit the birds on his property to be reduced to the danger point; the "poacher" is severely dealt with. By way of contrast Mr. Pearson cites New York State, where any one having a state shooting license may wander over his neighbor's fields in search of game birds unless restrained from doing so by "no trespass" signs of prescribed dimensions or through the official establishment of the area as a bird sanctuary, and not every land owner has the initiative, or will go to the expense, to secure such protection for his wild fowl. A public campaign of education, in which newspapers and public-spirited private agencies, as well as the federal and state authorities, are called upon to participate, is urgently needed if our game birds are not to follow the great auk and the dodo to extinction.

THE WATERFOWL OF BACK BAY, VIRGINIA.—Back Bay, Virginia, is a gratifying illustration of what conservation can accomplish when public sentiment is squarely behind the law. Mr. Ludlow Griscom, assistant curator of birds in the American Museum, has recently returned from a trip to this famous winter resort for wild fowl, made in the company of Mr. M. S. Crosby, and reports that ducks of all kinds are, if anything, more abundant there than they were ten years ago. In one day nineteen species were counted; canvasback, baldpate, Canada geese, and whistling swan were present in thousands, and many other species were common. Mr. Griscom in his analysis of the situation says:

When we consider that this state of affairs exists in spite of the fact that every marsh is owned by a gun club, every little island is a prized shooting ground, that the bay is covered with floating blinds and batteries, that one is never out of sight of houses and villages, and that these conditions have prevailed for many years, it will be apparent that the continued abundance of waterfowl requires some explanation in addition to the natural advantages of the territory. Primarily, of course, the abolition of market hunting—that great scourge of conservation—and of spring shooting is a necessity before waterfowl can be maintained in a settled district. Next, wise and proper game laws must exist, and in this respect Back Bay has the best and the most restrictive I know of in eastern America. Laws, however, are of little benefit unless public sentiment and respect are back of them, for at present neither the federal nor any state government has sufficient funds to employ a staff of game wardens adequate to enforce the law in localities where public sentiment is against it.

The most gratifying feature of hunting in Back Bay is this: that particularly restrictive laws have the approval of sportsman and layman alike. The latter has outgrown his bitterness over the abolition of market hunting, which deprived him of a living, as steady employment with the hunting clubs has given him a better one. While the public cannot shoot from the shore marshes or islands, as they are all private property, the bay shooting is not to be despised by anyone, and consequently there is no feeling against the clubs, as is the case, for instance, on Long Island. The natives realize that these clubs bring money and employment, that they do not spoil the shooting, and that people who are not millionaires and cannot afford a share in the property-owning clubs still flock to Back Bay during the hunting season, bringing more money and more employment. The majority unquestionably realize that the decrease of the ducks means inevitably a decrease in income and employment, and see that the game laws insure a goodly supply of game.

In three visits of several days each to this region over a period of ten years, I have never seen a violation of the law. In hundreds of trips to duck fields in central New York, and to scattered localities from Labrador to Florida, and from Florida to Texas, I have never spent a similar amount of time in any one place without seeing some violation of the law, or finding it held in contempt and disregard if the game warden's presence elsewhere was definitely established. This unfortunately is particularly true of the Gulf Coast and the prairies of southern Texas. Although in variety of species and abundance of individuals these regions still exceed Back Bay, a depletion of the waterfowl, inevitable unless public sentiment is aroused and educated, will result along the Gulf coast and in southern Texas when the population increases and natural conditions are destroyed through the encroachments of civilization.

The American Scenic and Historic Preservation Society held its twenty-ninth annual meeting in the auditorium of the American Museum on January 28. The part that this society has played in New York State and in the nation at large deserves more than casual mention, for, as Dr. George F. Kunz, its president, pointed out in his address, it was one of the first societies to arouse public interest in the preservation of sites that appeal on the score of their beauty or their historic significance, and throughout the three decades of its existence it has given forceful aid to the movement that has resulted in the establishment of national and state parks. In New York State alone there are today more than seven times the number of scenic and historic reservations that existed when the society first began its campaign. The administration in the public interest of no less than nine properties—three belonging to the society and six to New York State—has claimed a large part of the attention of the society during the past year, but the scope of its work has by no means been limited to this group.

A feature of the annual meeting was an illustrated address on "The Scenic Beauties and Engineering Difficulties of the Grand Cañon of the Colorado River," delivered by Mr. E. C. LaRue, hydraulic engineer and photographer of the party of eleven men of the United States Geological Survey, that surveyed 1800 miles of the Colorado River and its affluents from Wyoming to the Gulf of California. The perils faced by the party while their boats, as helpless seemingly as wisps of straw, were swept along by the tumultuous waters of the rapids, were realistically presented in the motion-pictures. The adventurous character of the survey and the importance of its results had attracted a large audience,—so large indeed that the lecture had to be repeated for the benefit of those who still packed the approaches to the auditorium after the doors had been closed for the delivery of the first address. On the platform, in addition to the trustees of the society, were a number of distinguished guests, including Mr. Frederick S. Dellenbaugh, who accompanied Major Powell on his second expedition through the Cañon, Mr. W. H. Jackson, the photographer of the Hayden Survey, and the Rev. Robert E. Jones, who was associated with the Geological Survey in the Grand Cañon region in 1880–82 as topographer.

The American Bison Society.—So fruitful in results has been the work of the American Bison Society that whereas in 1903 there were in the United States but 41 herds with a total of 969 animals, in 1923 according to the census for that year there were 147 herds, comprising 3878 head. Twenty years ago there were but 24 states in which bison were to be found, today all but eight states of the Union have examples of this animal. It is in Canada, however, that the bison is preponderant, with a resulting total for North America of 12,457 animals.

With the perpetuation of the bison fairly well assured, the society is earnestly devoting its energies to saving the pronghorn,—a much more difficult undertaking due to the fact that the animal is more delicate by nature and is

today beset by many agencies that threaten its existence. The annual report of the society for 1922–23 contains the first census of living pronghorn, compiled by the secretary of the society, Mr. Martin S. Garretson. It shows a total of 10,099 of these animals within the United States and of 11,749 within the United States and Canada combined. Although this aggregate is comparable to that of the bison, the forces of destruction arrayed against the pronghorn call for unrelaxed vigilance on the part of those who would safeguard this animal. Driven from its natural habitat on the plains and foothills, it is today subjected to the attack of the sheepherder and the homesteader, while the wolf and the bobcat take their toll of the antelope when it is helpless in the deep snow. In the Guano Valley, Lake County, Oregon, seventy-five of these animals were wantonly shot by Basque sheepherders, and during Mr. Garretson's trip through southwestern Idaho, made with a view to ascertaining the suitability of the region as a sanctuary, indubitable evidences presented themselves that the Basque sheepherders of that section too are spelling the doom of these fine animals. In the report for 1922–23 Mr. Edmund Seymour, president of the society, alludes to the purchase of six antelopes in Canada and their successful transportation to the Wichita National Preserve in Oklahoma as the most notable achievement of the society during the year, but in many other ways the society has given evidence of its devotion to the cause of our disappearing wild life.

HISTORY OF THE EARTH

Mr. Edward J. Foyles, of the department of geology and vertebrate palæontology, American Museum, has recently issued in the *Thirteenth Report of the Vermont State Geologist* his "Preliminary Report on the Ordovician Formations of Vermont." The report is based on a study of the Fort Cassin rocks and fossils in the American Museum, as well as on field work undertaken in the Lake Champlain region during the summers of 1921 and 1922. Two of the principal localities, Shoreham and Fort Cassin, lie to the east of the lake; the third, Providence Island, is located somewhat north of these points in the lake itself. The purpose of the papers, as announced in the introduction and worked out in the text, "is to suggest the limits of the Beekmantown formation of the Lower Ordovician as it occurs in the Champlain valley of Vermont; to show that the Fort Cassin rocks constitute, not a single formation known as the Beekmantown, but a terrane consisting of two formations, neither of which is Beekmantown; and to demonstrate that the Providence Island rocks, which have mostly been assigned to the Beekmantown, have very few if any beds of Beekmantown age, but belong to higher horizons."

WILLIAMS GALÁPAGOS EXPEDITION

Many New Species of Moths Obtained in the Archipelago.—In his résumé of the Williams Galápagos Expedition (*Zoologica*, Vol. V, No. 1) Mr. William Beebe reports that the insects taken by the expedition totaled 3000, of which no less than 626 were moths (exclusive of Microlepidoptera). For the most part these had been lured to their doom by a powerful searchlight which nightly bored a tunnel of radiance through the darkness. Of the moths of the Galápagos Archipelago comparatively little was known prior to the working-up of this collection, evidenced by the fact that of the 52 species into which Mr. William Schaus, honorary assistant curator in the United States National Museum, divided the material, exactly one half are new to science, while only 4 of the remaining 26 species had hitherto been reported from the archipelago. There were 38 Microlepidoptera, which, as determined by Messrs. A. Busck and C. Heinrich, added 9 species to the total. Of the new species 2 have been named for Mr. Harrison Williams, who initiated the undertaking and generously placed at the disposal of Mr. Beebe's party the steam yacht "Noma" in which the cruise was made, 2 for Miss Isabel Cooper, and 2 for Miss Ruth Rose, who participated in the expedition, while the name of Mr. Beebe has been associated with a specimen representing a new genus. Mr. Schaus's study of the material—with a classified list of the species, the number of specimens of each, the date and locality of capture, and, where the species are new to science, the detailed description—has been published in *Zoologica*, Vol. V, No. 2; field observations regarding the material collected are graphically presented by Mr. Beebe in *Zoologica*, Vol. V, No. 3. Among the most striking of Mr. Beebe's observations are those relating to the remarkable partiality shown by birds of the islands for butterflies and moths, a phenomenon not to be explained by an absence of other insect food, for grasshoppers were present in abundance.

NEW YORK ZOOLOGICAL SOCIETY

TROPICAL RESEARCH STATION.—On February 11 Mr. William Beebe and his staff of assistants sailed on the "Mayuro" to undertake another season's work at Kartabo, British Guiana, the Tropical Research Station of the New York Zoological Society. In addition to the director, the party included Dr. Alfred Emerson, assistant director; Mr. John Tee-Van, research assistant and cinematographer; Mr. William Merriam, assistant in field work; Mr. Harold Tappin, assistant in entomology; Mr. Herman Rogers, assistant in photography; Mr. Harry Hoffman, artist; Miss Isabel Cooper, scientific artist; Mrs. Helen Tee-Van, assistant scientific artist; Miss Ruth Rose, historian and technicist; and Mrs. Katherine Rogers, assistant microscopist, and Mr. Serge Chetyrkin, assistant field naturalist. Among the objects Mr. Beebe has in view is the rounding out of his notes on the ecology of the quarter of a square mile of jungle to which he has been giving intensive study during his previous sojourns. He plans, also, if possible, to bring back to New York living specimens of the hoactzin, a bird that in the young stage has two toes on each wing as aids in climbing and literally moves about on all fours. Finally Mr. Beebe is completing plans for a trip to Mt. Roraima, to be made either on this or on his next trip to British Guiana.

BIRDS

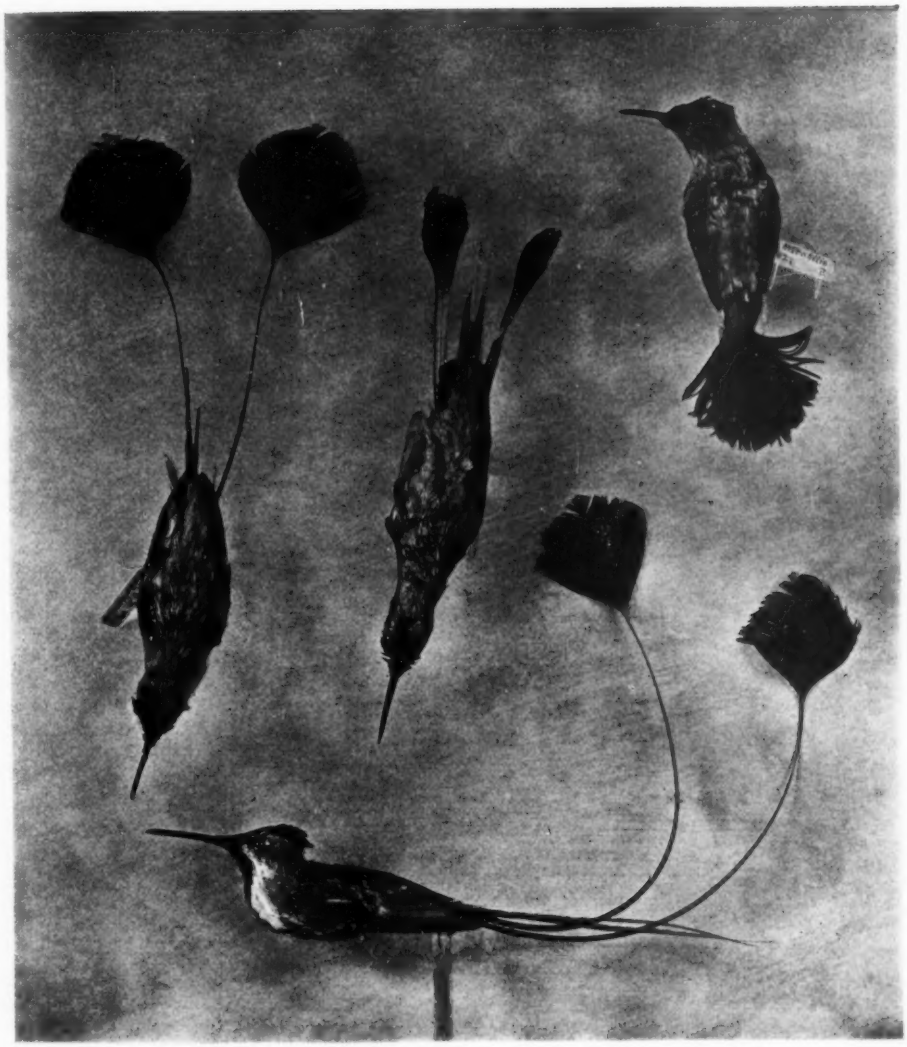
MR. LUDLOW GRISCOM, assistant curator of birds, American Museum, sailed on February 5 on an expedition to Veragua, western Panama. He is taking three assistants: Mr. Rudyerd Boulton of the University of Pittsburgh, Mr. George Albert Seaman, field collector, and Mr. J. Manson Valentine of the Peabody Museum, Yale University, volunteer assistant. The party hopes to reach the subtropical or cloud-forest zone in the unexplored mountains of the interior, to determine its extent and ascertain whether it is disconnected from the high mountains of Chiriquí. Little is known about this region, and no collection of its birds exists in America. Somewhere in Veragua the tropical lowland fauna of eastern Panama meets a limited fauna known only from southwestern Costa Rica and Chiriquí, but the location of the barrier separating them and the factors causing it await determination. Mr. Griscom expects to leave Mr. Seaman in the field to make thorough collections at all desirable localities. Still as well as motion pictures will be taken to illustrate the ecology, topography, scenery, and natives.

THE PARADISE RACQUET-TAILED HUMMING BIRD.—Through an exchange of material with Mr. A. L. Butler the department of birds, American Museum, has secured four specimens (2 mature males, 1 immature male, and 1 female) of the unusually interesting and rare humming bird (*Loddigesiornis mirabilis*), known as the paradise racquet-tail.

This bird has several claims to distinction. Known only from the Chachapoyas Valley of Peru and obtainable there only when a certain shrub on which it is dependent for its food is in flower, it is a species much coveted because of its rarity. Excepting an immature female in the collections of the Museum of Comparative Zoölogy in Cambridge, the four specimens mentioned are the first to come into the possession of a scientific institution in America.

Yet its interest on the score of rarity is subordinate to that which it has as one of the few cases among birds of marked sexual dimorphism. All other humming birds have not less than ten tail feathers; but the male of *Loddigesiornis mirabilis* has but four. Yet the striking elongation of two of these feathers in the male bird is compensation, from the æsthetic standpoint at least, for the reduced number. Only the racquet-shaped end of the tail feather is visible in the immature specimen but in the mature male this appears as a culminating ornament at the end of a long thin upward-curved feather-shaft of graceful sweep. The shape of the elongated tail feathers of the female is, on the other hand, strikingly different and less spectacular, and, in contrast to the male, she has the normal number of tail feathers (ten). The glittering blue crown of the male, which shows purple in certain lights, and its shimmering emerald throat are other points of beauty.

The four specimens originally found place in the collection of Count von Berlepsch, having been obtained by his collector, O. T. Baron. In addition to *Loddigesiornis*, four other species of humming birds new to the collections of the American Museum were obtained through exchange, as well as several specimens of species which exist in America only in this Museum. The collection of humming birds in this Museum is now the most nearly complete in the world.



The paradise racquet-tailed humming bird, an interesting case of sexual dimorphism.—The specimen in the upper right-hand corner is an immature male, in which only the racquet-shaped end of the tail is visible. The ornamental elongation of the tail is a conspicuous feature of the two adult males (at the left and at the base of the picture respectively). The female (center) differs strikingly in appearance from her mate. The specimens were recently acquired by the American Museum

MUSEUM LIBRARY

A Valued Gift to the Museum Library.—Through the generosity of Mr. Ogden Mills the library of the American Museum has obtained a set of Lord Lilford's sumptuous work, *Colored Figures of the Birds of the British Isles*. This gift from one who has enriched the Museum by many volumes of great rarity, beauty, and scientific interest, is particularly valued for the magnificent series of 421 plates which it contains, contributed by such artists as A. Thorburn and J. G. Keulemans. Lord Lilford was for many years president of the British Ornithologists' Union, of which he was one of the founders, and the monumental work presented by Mr. Mills is one of the standard contributions to ornithology.

EXTINCT ANIMALS

Ape of the Western World Restudied.—It would seem that *Hesperopithecus* is a

name well chosen by Honorary Curator Henry Fairfield Osborn for the genus of anthropoid apes, known from two fossil teeth (one of which is very much worn) discovered in Nebraska in 1922. The actual discovery had been made some time before but the type fossil tooth actually reached the Museum only two weeks after Professor Osborn had advised William Jennings Bryan to study the fossils themselves and not the disputations of the doctors about them. This advice was summed up in the Scriptural verse, "Speak to the earth and it shall teach thee," and by way of showing the pertinence of this counsel there arrived at the Museum the first recognized anthropoid ape tooth found in America.

As in the case of numerous other discoveries of this kind, authenticity was challenged by many scientists. While the American Museum staff agreed that the tooth represented an upper molar of an anthropoid ape, other palæontologists, both in America and Great Britain, questioned this conclusion. Several authors sought to relate it to the fossil type of bear known as *Hyænarctos;* others thought it had affinities with the Carnivora, especially the panda of Asia or the raccoon-like *Potos* of South America; some suggested that it was not an anthropoid but related to the South American monkeys; it was even intimated that the tooth belonged to one of the ancestral horses.

In view of these striking differences of opinion, the American Museum specialists, Dr. W. K. Gregory and Dr. Milo Hellman, subjected the tooth to a more searching analysis and finally reached the following conclusions, published in the *Bulletin* of the Museum, December 4, 1923: first, the tooth in all probability belongs among the higher Primates known as anthropoid apes; second, the greater number of resemblances of the tooth appear to be with the gorilla and the chimpanzee rather than with the orang. Doctor Gregory leans toward the view that the anthropoid ape affinities of the type predominate while Doctor Hellman still regards resemblances to a human tooth as being of considerable significance, and they state that the range of variation in the crown and root characters of the molars both in the human family and the anthropoid ape family is great enough to warrant either viewpoint. The type tooth is probably a second upper molar, as originally decided by Professor Osborn, while the second very much worn tooth found in the same locality is pretty surely an upper molar and probably the third or back molar of *Hesperopithecus.*

In the meantime the leading anatomists of the world have been given an opportunity to study this question for themselves through beautifully prepared casts. Among the authorities who have received replicas of the tooth are distinguished anthropologists and palæontologists of Europe, such as Boule, Depéret, Dollo, Abel, Forster Cooper, Smith Woodward, Elliot Smith, Keith, Pompeckj, Broili, Capellini, Plate, Læche, von Huene, Sergi, Dubois, and Martin, and in this country, Hrdlička, Miller, Boas, Merriam, Lull, and Sinclair. This reciprocity and interchange of facsimile casts of original materials enable, in this case, twenty-six different institutions in various parts of the world to examine for themselves and to form their own opinion as to the possible relationship, or lack of relationship, of the find to human ancestry.

FISHES

Sea Dragons from Australia.—Through the courtesy of Dr. C. Anderson, director of the Australian Museum, the American Museum has recently come into possession of a most wonderful example of nature's handiwork, in the shape of a little sea horse or sea dragon, known scientifically as *Phyllopteryx eques.* As the Rev. Tenison Woods writes in *Fishes and Fisheries of New South Wales,* "One step more, in evolution, and it would have been a bunch of kelp." If this be not mimicry, there is no such thing.

If the reader will imagine a small child clipping off bits of kelp, sticking them here and there on a good-sized sea horse, adding a few tufts of sea weed, and finally inserting a number of spines for good measure, he will have a pretty good idea of this extraordinary little creature.

Accompanying it were three specimens of a relative of this sea dragon,—less elaborately decorated, though to make up for this deficiency, they were in life brightly colored. These strange fishes are seldom seen: as Mr. McCulloch writes in the *Australian Museum Magazine,* for April, 1923: "Whenever the winds blow harder than is usual from the sea, the waves churn up the animals and plants which live just below the lowest limits of the tides. Our ocean beaches at such times become strewn with an assemblage of marine

Kelplike in appearance but a fish in reality, the sea dragon (*Phyllopteryx eques*) is one of the examples in nature which one is tempted to ascribe to protective mimicry. On the left is another sea horse (*Phyllopteryx foliatus*) from Australia. The specimens were obtained by the American Museum through the courtesy of Dr. C. Anderson, director of the Australian Museum

organisms which are rarely exhibited to our view under any other circumstances." And this flotsam and jetsam now and then includes examples of these strange little sea horses.

In view of the rarity of these fishes, it is somewhat surprising to find that one of them, *Phyllopteryx foliatus*, was described as early as 1804, and the other, *Phyllopteryx eques*, in

1865. The name *Phyllopteryx*, leaf-finned, in allusion to the flowing appendages with which these fish are decorated, is very appropriate, but it is a pity that the term *foliatus*, bearing-foliage, could not have been applied to the species described in 1865, which is far more like an animated bit of kelp than is its relative. Scientific names, once given, must not be changed, even though they cease to be fitting, but it is a pity the names cannot be transposed.

This recalls the case of the great eggs from Madagascar which were christened *Æpyornis maximus*, though later discoveries have shown that while the eggs are still *maximus*, the bird that laid them was surpassed in size by some of her relatives; science is sometimes in too much of a hurry in applying adjectives.—F. A. L.

EUROPEAN ARCHÆOLOGY

A Gift from M. Zacharie Le Rouzic.—Through the active interest of Mrs. Henry Fairfield Osborn, the department of anthropology, American Museum, recently received a collection of archæological objects recovered by excavation in the region of the great megalithic monuments of Brittany or, to be more specific, that part of Brittany known at present as the Department Morbihan. The specimens came as a gift from M. Zacharie Le Rouzic, curator of the Musée J. Miln, situated in the village of Carnac in the midst of some of the most wonderful of the Late Stone Age antiquities. It will be recalled that President and Mrs. Osborn visited this locality in 1921 and that President Osborn published an illustrated article in Natural History for May–June, 1922, giving an account of his observations.

The collection appears to include specimens typical of both the Early and Late Neolithic periods and comprises roughly worked flints—cores, flakes, and scrapers; several mealing stones, hammer stones, rubbing stones, and polished celts; pottery fragments, and some minute bits of bone—perhaps human bones from a burial urn. Included in the collection are also a number of glass beads of various types belonging evidently to a much later period of culture and possibly buried for magical purposes in the vicinity of the great stone monuments, which are still held in awe and veneration by the surviving Bretons.—N. C. N.

The Iron Age of La Tène.—A notable recent addition to the Osborn Library is a monograph by Professor Paul Vouga (1923) on La Tène, the famous Swiss type station on Lake Neuchâtel. Originally intended as a detailed account of the results of excavations pursued from 1907 to 1917, the author extended the scope of his work to include an account of all the known discoveries belonging to the Helvetian site of La Tène, and has produced an invaluable work of reference. Associated from early youth with the pioneers of Swiss archæology—among them his father, Emile Vouga, to whom the work is dedicated—Professor Vouga is singularly fitted to give an authoritative account of the various explorations at La Tène since its discovery in 1858. His book is lavishly illustrated with two excellent maps and several cross sections, a few well-chosen text figures, and no less than fifty plates picturing over 600 of the various articles found at La Tène during the excavations of recent years, in which the author took part. Not only are all these articles drawn to scale, but the plate descriptions give page references to the text concerning every specimen pictured. The text is a model of clearness and brevity, and scrupulously observes a fine distinction between the record of facts in regard to the specimens described, and the advancement of hypotheses which might conceivably explain those facts.

The volume opens with a description of the geographic situation of La Tène and a brief historic sketch recounting all the various excavations made from its discovery down to the present time. Then comes a detailed account of the topography and geology of the site by Professor Auguste Dubois. In less than three pages Professor Vouga outlines the causes which led to the wide dispersal of specimens from La Tène, and to much confusion in identifying them. The first part closes with a classified inventory of all the articles found at La Tène, indicating the thirteen different institutions where seventy different kinds of artefacts may be found, represented by more than 2500 specimens. The main body of the work is devoted to describing the specimens discovered from 1907 to 1917, and these are grouped with such excellent judgment that the very chapter titles supply a vivid picture of the life of prehistoric man in the settlement of La Tène. The weapons, or fragments of weapons, include swords, lances, pikes, javelins, bows and

arrows, the metal scales for coats of mail, and the bosses and hand-grips of wooden shields. Toilet articles are represented by shears, razors, and tweezers, and ornaments by fibulæ, bracelets, torques, pins, beads, etc. The fisherman's activities are represented by fishhooks, harpoons, tridents, and boat hooks, and the agriculturist's by sickles, scythes, and pruning hooks—perhaps harrows as well. Then there are mills for grinding meal, mortars or presses for extracting the juice of fruits, kettles of bronze reinforced with iron, jars of pottery, and various wooden dishes. A knowledge of basketry or weaving is indicated by fragments of fabrics made of woven or plaited straw. The wheelwright's work is shown in the fragmentary remains of vehicles—among them a perfect wheel illustrated *in situ*, while bits and spurs, and some fragments which may possibly be the remains of a pack-saddle testify to the work of the harness-maker. Carpenters and joiners left their mark on slabs of wood, notched or bored for use as piles, beams, and other purposes which can only be conjectured. Spikes and braces for fastening wooden structures, and many wood-working tools are found, as well as tools for working leather and metal. Among several bizarre objects figured, which may have been used in games of some sort, it is quite a shock to find two fairly recognizable dice, one of bone and one of bronze. Is it possible that prehistoric man played a primitive game of craps? Some degree of commercial activity is inferred from the presence of gold coins, weights, and balances.

There are three supplementary chapters—one by R. Forrer on the gold coins, one by C. Keller on the fauna, and one by E. Pittard on the human remains found at La Tène. In summing up the evidence which he has been so largely instrumental in collecting, Professor Vouga reaches the conclusion that La Tène was a fortified, garrisoned trade depot, that the remains found there represent only one cultural phase, that of La Tène II, and that its occupation may be dated approximately as lasting from 250 B.C. to 100 B.C.—C. D. M.

Aurignacian Skeletons Discovered at Solutré, France.—Reports lately received give particulars in regard to a recent discovery of the greatest interest, made by MM. Depéret, Arcelin, and Mayet at the famous type station of Solutré—namely, the skeletal remains of no less than five individuals associated with implements of Aurignacian type and embedded in the deposits immediately beneath the great horse magma, which is also of Aurignacian age. Three complete skeletons, two male and one female, were laid out as for ceremonial burial, each placed with the body lying in a west to east direction, and each burial place marked by two large slabs of limestone, which must have stood well above ground at the time of sepulture. Close to the woman's skeleton were found skeletal fragments belonging to two very young children. One of the male skeletons was embedded in an extensive "hearth," or layer of ashes and calcined bones, in which there were also found 316 flint implements of very indifferent workmanship. Inside the bones of the other male skull, embedded in earth, there was found a flint arrow point. Particular interest attaches to the anatomical features of these skeletons which show some marked deviations from the Crô-Magnon type as observed in the human remains from the type station in the Vézère Valley, and those of similar type more recently discovered in the Grottes de Grimaldi and described by Verneau. The general proportions of upper and lower limbs, as well as the peculiar features of their several bones which are characteristic of all Crô-Magnon types of Aurignacian age, are not found in these Aurignacian skeletons of Solutré.

The height estimated for the two male skeletons is considerable (6 feet, and 5 feet, 9 inches respectively), and in this regard, as also in certain characters of the skull—namely, the large cranial capacity, the outlines of the sagittal and horizontal curves, and the shape of orbits, nose, and lower jaw—they resemble the established Crô-Magnon type. But in two important points they differ widely. In the Crô-Magnon type the cheek bones are high and prominent and project laterally in such manner as to add very considerably to the breadth of the face, which thus becomes "disharmonic" with the long and narrow, or dolichocephalic, skull. In the skull figured from Solutré (No. 2) the cheek bones show no pronounced projection, but lie very smooth and close to the side of the face. The latter is broad but not disharmonic with the skull, as that also is decidedly broad. In fact, perhaps the most striking anatomical feature of these Aurignacian skeletons of Solutré is the mesaticephalic, almost sub-brachyce-

phalic, shape of the skull, since all the Aurignacian skulls hitherto known are invariably dolichocephalic.

These are by no means the first human remains to be discovered in the great prehistoric deposits of Solutré, as a number are recorded from earlier times. Unfortunately the present exact methods of determining stratigraphy had not then been developed, nor was the surpassing importance of these human documents fully realized. Consequently there is now no means of determining the stratigraphic position of many of these remains, while others—such as the complete human skeleton interred with Solutrean leaf points, reindeer bones, and a figurine of a reindeer, discovered in 1868 by the Abbé Ducrost—have been lost beyond recall. It is a great satisfaction to know that the further excavation of the great type station of Solutré is now being prosecuted so vigorously, and that it is in such expert hands. We may confidently hope for further discoveries to increase our knowledge of the fossil men of Solutré.—C. D. M.

MAMMALS OF THE WORLD

MONKEYS FROM BRITISH EAST AFRICA.—Recently the American Museum received a valued accession to its great primate collection, which through the efforts and personal attention of Dr. Frederic A. Lucas has been steadily increased in recent years and put in such fine condition that the exhibits are now, it is believed, the best in any museum.

The gift consisted of five skins, three skeletons, and two skulls of British East African monkeys, presented through the generosity of Captain Neite Caldwell of Nairobi.

Colobus rufomitratus, Peter's red-capped *Colobus*, represented by three of the skins, belongs to the reddish, generally more short-haired group of the Colobinæ, ranging across equatorial Africa. Its bright rufous crown, bordered with black, and erect bunches of hair give it a distinctive appearance. The seal brown, nearly black, fine hair of the upper parts and tail contrasts with the gray of the under side and limbs. It was discovered as early as 1879 but for many decades was known only from a single specimen preserved in the Berlin Museum.

This is also true of the second species presented, the crested mangabey, *Cercocebus galeritus*, to which the other two skins refer. It is the easternmost representative of the mangabeys, a group really West African in distribution. Some forms show a remarkable variety in the arrangement of the lengthened hair forming the head crest and shoulder patches. The general color of this species is grayish brown with darker hands, feet, and tail. The hair of the eyebrows and crown is much lengthened and together with that of the nape forms a conspicuous crest.

Probably these are the first skins of these monkeys to arrive in this country. This may appear strange considering that in the wake of Colonel Roosevelt's successful African explorations, so many Americans made collections in British East Africa. But these Primates are very local in their distribution, being confined to the forest galleries along the few watercourses near the east coast north of Mombasa, chiefly along the Tana River.—H. L.

THE SIXTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS is scheduled to take place in Cambridge and Boston, April 15–17. The sessions during the first two days will be held in the Museum of Comparative Zoology and will be devoted to the reading of papers, discussions, and business. As a part of the general program a symposium has been planned on "The Scientific and Economic Importance of Predatory Animals." On the evening of April 15 the society will hold a session in the building of the Boston Society of Natural History, and on the last day of the session, thanks to the kind invitation of Prof. W. E. Castle, a visit will be made to the Genetics Laboratories at Bussey Institution, Forest Hills, Massachusetts.

A NEW VOLUME BY ERNEST HAROLD BAYNES.—*Jimmie, the Story of a Black Bear Cub*, by Ernest Harold Baynes, has recently been put into book form by the Macmillan Company. It is a companion volume to *Polaris, the Story of an Eskimo Dog*, and is one of the author's most fascinating narratives. Mr. Baynes's admirers and friends, especially those who have heard him tell about Jimmie, will be delighted to know that the story is now set down, so that they may have it permanently available. The book is copiously illustrated with photographs by Mr. and Mrs. Baynes, and these appealing pictures make the narrative doubly telling. It is hoped that Mr. Baynes's stories of "Sprite, the Red Fox," and "The Little Wild Boar," and others will also be put into book form.—G. C. F.

THE ELEPHANT IN WAR.—There has always been some question in the minds of historians

as to the source of Hannibal's elephants, those which he took into Spain and used in the conquest of northern Italy. We are indebted to a member of the Board of Trustees of the American Museum, Mr. Madison Grant, for an informing Note on this subject and we shall be glad to have further data from others who are interested:

The animals used by the Carthaginians could not have come from Asia without having left some record of their progress across Syria, Egypt, and Cyrene on their way to Carthage. The only possible way of getting the Sudan or Abyssinian elephants was to float them down the Nile as was done by the Romans much later. As we have no record that this was done, I am convinced that we must look to the west or south of Carthage for the source of supply.

Hannibal brought his elephants into Italy through Spain in the year 218 B.C. Pyrrhus, at an earlier date, about 281 B.C., brought elephants across the Adriatic from Epirus, and this was the first time the Romans met the elephant in war. The source of these elephants was Asiatic and their origin is definitely known. After Alexander's death his successor in the extreme eastern part of his empire obtained by war and as tribute Indian elephants from Indian rulers in the neighborhood of the Indus River. A certain number of these are known to have been sent across Asia Minor to Macedonia and hence to Epirus.

In a later communication Mr. Madison Grant supplies additional information regarding the elephant in war and in domestication:

The Indian elephant, so far as we know, is the only one that has ever been domesticated. The elephants the Romans had in their circuses were, like the rhinoceroses and other bulky animals, floated down the Nile from what is now the Sudan, and nothing of this sort seems to have occurred to supply the Carthaginian army with its numerous elephants.

All this is a matter of fairly definite record. If elephants at this time or earlier had been transported across the Arabian and Syrian deserts, from Egypt and eastern Libya to Carthage, there would have undoubtedly been some record, especially as we know the history of Egypt under the Ptolemys in detail.

Hannibal's elephants, it will be recalled, started from Spain and it would seem as though they had been drawn from the northwestern corner of Africa. India or the Sudan would have been too remote a source. Some years ago, a "pygmy elephant" was discovered in the Congo—in fact, the New York Zoological Park had the type specimen, and at the present time there is a small specimen on exhibition in the park. This is the species of elephant now living nearest the northwestern corner of Africa.

It appears that a Roman general, Suetonius Paulinus, about 45 A.D. reached the high Atlas range in Morocco and on the south side of the range found "swarms of elephants in the Atlas forests." These may have been the same species as the "pygmy elephant" or they may have been a larger species but, at all events, we have there a definite record of the occurrence of African elephants in Morocco and, personally, I believe that this is the source from which Hannibal drew his supplies.

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